TE7

Diagnostic Ultrasound System

Service Manual (Advanced)

Revision 5.0

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Version Information

Mindray may revise this publication from time to time without written notice. The detailed information is shown below:

Version	Release Date	Reason for Revision
1.0	2014.10.14	Initial release
2.0	2015.01.06	Change "C.1.30 Z0602 Touch Screen Function Test" in chapter Appendix C
3.0	2015.7	Section 2.1.4, add printer SONY UP-D898MD and SONY UP-X898MD
4.0	2015.9	Section 3.2.1.3, add the travelling case unpacking process Section 7.1, change the No of the main unit back cover with three-probe and single-probe Section 9.2.5, add the process of mounting VESA connecting rod. Section 11.2.1.3, add supporting disinfectants of the main unit.
5.0	2015.9	Section7.1, add number and picture of ECG module. Section 8.2.9, add steps of connecting the ECG module.

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Descriptions Committed

The following marks are used for describing menu items, buttons on dialog boxes and other basic operations in the manual:

- [Menu item or key]: the square bracket for enclosing menu item or key refers to the menu items or the keys on dialog boxes.
- Click [Menu item or key]: move the cursor to the menu item or the key on the dialog box, and then press <Set>. Or, click other optional keys on touch screen.
- [Menu item]-[Sub-menu item]: select sub-menu item based on the operation path.

1 Safety Precautions

This chapter describes important issues related to safety precautions, as well as the labels and icons on the ultrasound machine.

1.1 Meaning of Signal Words

In this service manual, the signal words ⚠**DANGER**, ⚠**WARNING**, ⚠**CAUTION** and **NOTE** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please be aware of the meaning of the signal words before reading this manual.

Signal word	Description
⚠**DANGER**	**Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.**
⚠**WARNING**	**Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.**
⚠**CAUTION**	**Indicates a potentially hazardous situation that, if not avoided, may result in minor or moderate injury.**
NOTE	Indicates a potentially hazardous situation that, if not avoided, may result in property damage.
Description	Important information that helps you to use the system more effectively.

1.2 Symbols

The following tables provide location and information of the safety symbols and warning labels, please read carefully.

1.2.1 Meaning of Safety Symbols

Symbol	Description
	Type-BF applied part Note: The ultrasound probes connected to this system are type-BF applied parts.
	"Caution" indicates the points that you should pay attention to. Be sure to read the manual concerning these points before using the system.

1.2.2 Warning Labels

No.	Warning Labels	Description
1.		There is explosion risk if the system is used in flammable anesthetics.
2.	The following labels are available when the system works with the trolley. a b c	(a) Do not place the system with the trolley on a sloped surface. Otherwise the system may slide, resulting in personal injury or the system malfunction. Two persons are required to move the system over a sloped surface. b DO NOT sit on the trolley. c When the casters are locked, DO NOT push the trolley.

1.2.3 General Symbols

This symbols used in the device are listed in the following table. Meanings are:

No.	Symbol	Description
1.		Caution!
2.		Type-BF applied part
3.		No user serviceable parts (power adapter)
4.		Battery installation position
5.		Product serial number
6.		Manufacture date
7.		Battery status indicator
8.		AC (Alternating current)
9.		Standby status indicator

No.	Symbol	Description
10.		Probe connector unlocking symbol
11.		Probe connector locking symbol
12.		Extending port
13.	HDMI	HDMI port
14.		USB port
15.		Network port
16.		Probe socket
17.	19V ⎓ 7.9A MAX	Power consumption
18.	⚠ 4kg/8.8lbs	Maximum load for printer bracket on the trolley
19.	AC 100-240V 50/60Hz 240VA ⚠	Trolley input
20.	⚠ AC 100-240V 50/60Hz 407VA	Trolley output
21.	⚠ 3.1kg/6.8lbs	Maximum load for storage bin on the trolley
22.		WEEE mark
23.	EC REP	Authorized representative in the European Community
24.	CE 0123	This product is provided with a CE marking in accordance with the regulations stated in Council Directive 93/42/EEC concerning Medical Devices. The number adjacent to the CE marking (0123) is the number of the EU-notified body certified for meeting the requirements of the Directive. The radio device used in this product complies with the essential requirements and other relevant provisions of Directive 1999/5/EC (Radio Equipment and Telecommunications Terminal Equipment Directive). The product is in compliance with ETSI EN 300 328 and ETSI EN 301 489. The product complies with the Council Directive 2011/65/EU

1.3 Safety Precautions

Please read the following precautions carefully to ensure the safety of the patient and the operator when using the probes.

⚠DANGER: Do not operate this system in an atmosphere containing flammable or explosive gases such as anesthetic gases, oxygen, and hydrogen or explosive fluid such as ethanol because an explosion may occur.

1.3.1 Electric Safety

⚠WARNING:

1. **Connect the power plug of this system and power plugs of the peripherals to wall receptacles that meet the ratings indicated on the rating nameplate. Using a multifunctional receptacle may affect the system grounding performance, and cause the leakage current to exceed safety requirements. Use the power cord accompanied with the system provided by Mindray.**
2. **Disconnect the AC power before you clean or uninstall the ultrasound machine, otherwise, electric shock may result.**
3. **When using peripherals not powered by the auxiliary output of the ultrasound system, or using peripherals other than permitted by Mindray, make sure the overall leakage current of peripherals and the ultrasound system meets the requirement of the local medical device electrical regulation (like enclosure leakage current should be no more than 500uA of IEC60601-1:2005), and the responsibility is held by the user.**
4. **In maintenance or assembly/disassembly, make sure other cables are connected well before the battery connecting cable is connected, otherwise the system may be damaged due to hot-plug.**
5. **Do not use this system simultaneously with equipment such as an electrosurgical unit, high-frequency therapy equipment, or a defibrillator, etc.; otherwise electric shock may result.**
6. **This system is not water-proof. If any water is sprayed on or into the system, electric shock may result.**

⚠CAUTION:

1. **DO NOT connect or disconnect the system's power cord or its accessories (e.g., a printer or a recorder) without turning OFF the power first. This may damage the system and its accessories or cause electric shock.**
2. **Avoid electromagnetic radiation when perform performance test on the ultrasound system.**

3. **In an electrostatic sensitive environment, don't touch the device directly. Please wear electrostatic protecting gloves if necessary.**
4. **You should use the ECG leads provided with the ECG module. Otherwise it may result in electric shock.**
5. **Maximum output power of the trolley is 240 VA.**

1.3.2 Mechanical Safety

⚠WARNING:

1. **When moving the system, you should first power off the system, disconnect the system from other devices (including probes) and disconnect the system from the power supply.**
2. **Do not subject the transducers to knocks or drops. Use of a defective probe may cause electric shock to the patient.**

⚠CAUTION:

1. **Do not expose the system to excessive vibration (during the transportation) to avoid device dropping, collision, or mechanical damage.**
2. **When you place the system on the mobile trolley and move them together, you must secure all objects on the mobile trolley to prevent them from falling. Otherwise you should separate the system from the mobile trolley and move them individually. When you have to move the system with the mobile trolley upward or downward the stairs, you must separate them first and then move them individually.**
3. **Do not move the ultrasound system if the HDD indicator is green, sudden shake may cause the HDD in damage.**
4. **When moving the trolley with mounted system, please take care of the connector of the power adapter in case of damage.**

1.3.3 Personnel Safety

Note:

1. The user is not allowed to open the covers and panel of the system, neither device disassemble is allowed.
2. To ensure the system performance and safety, only Mindray engineers or engineers authorized by Mindray can perform maintenance.
3. Only technical professionals from Mindray or engineers authorized by Mindray after training can perform maintenance.

1.3.4 Others

Note:	For detailed operation and other information about the ultrasound system, please refer to the operator's manual.

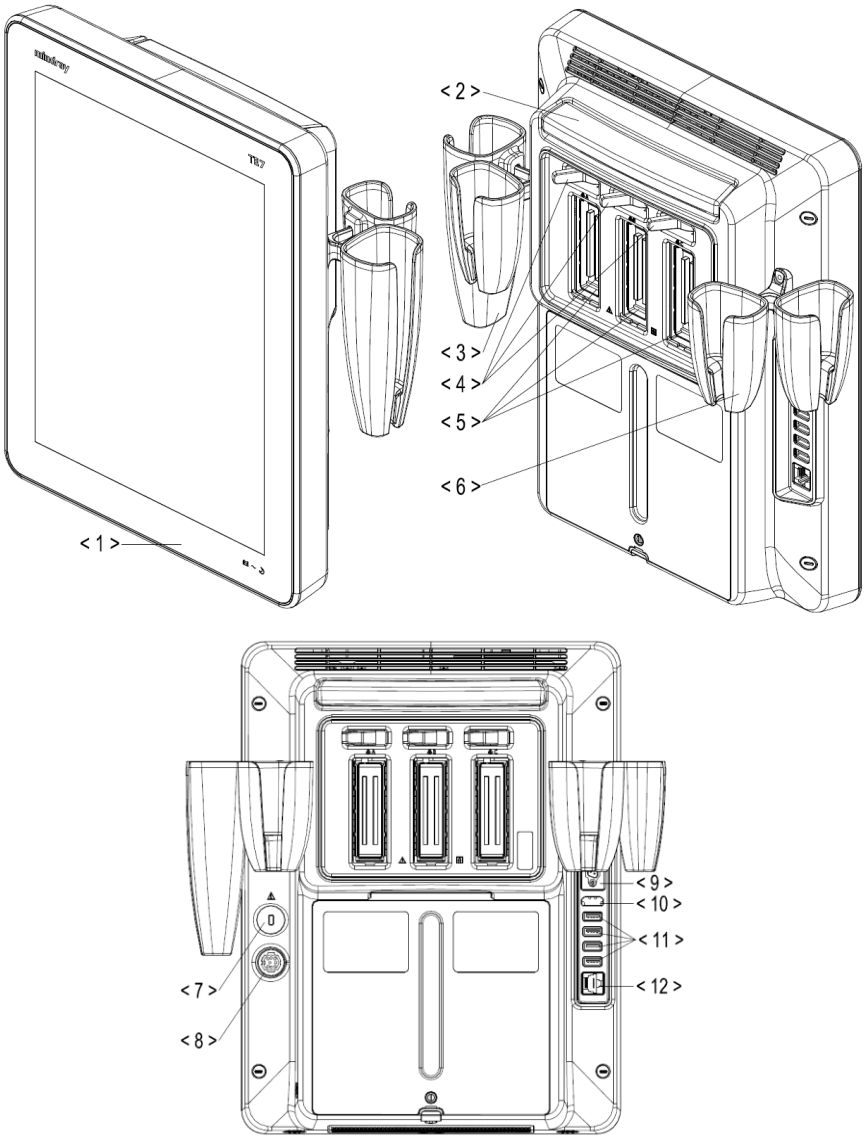
2 Product Specifications

2.1 Introduction

2.1.1 Intended Use

The diagnostic ultrasound system TE7 is intended for use in clinical ultrasonic diagnosis.

2.1.2 System Appearance

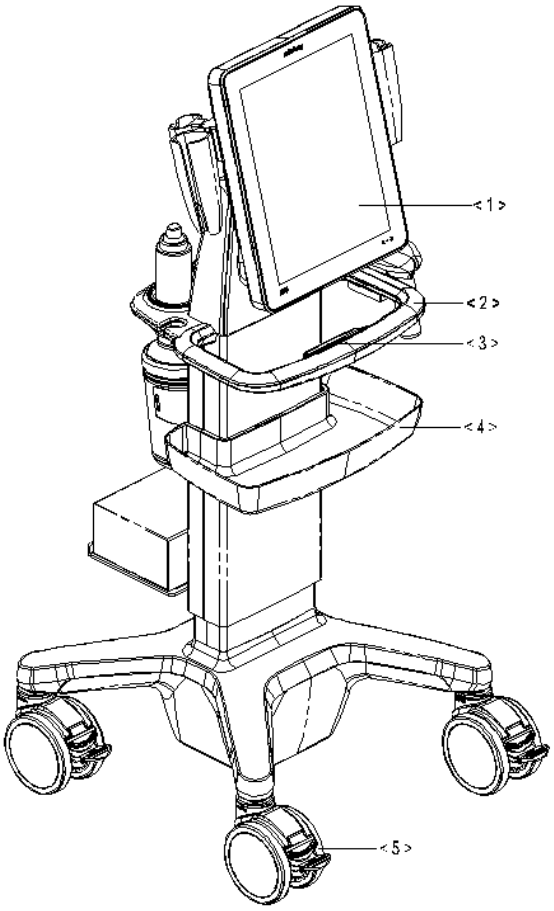


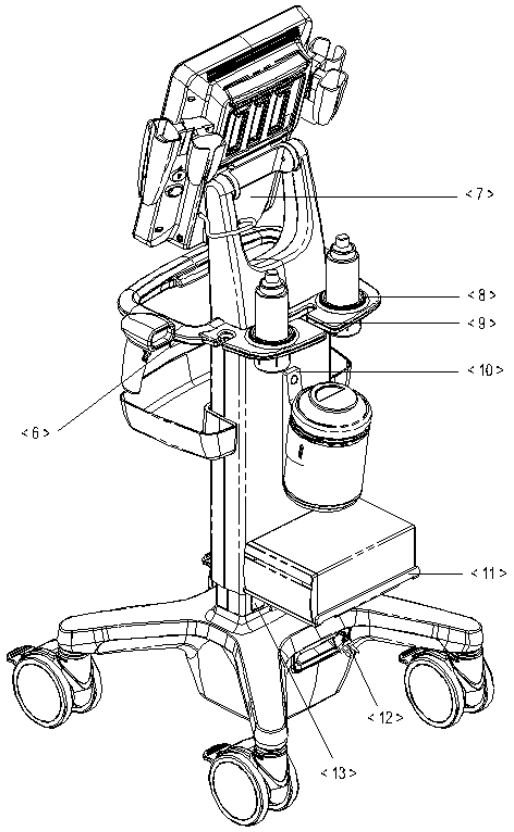
No.	Name	Function
1	Touch screen and monitor	Operator-system interface or control; displays the image and parameters during the scan.
2	Telescoping handle	Used for moving the system occasionally.
3	Intra-cavity probe holder	Used for placing the probe.
4	Probe locking switch	Locks or unlocks the probe connecting with the main unit.
5	Probe port	Connects a probe to the main unit.
6	Probe holder	Used for placing the probe.
7	Kensington lock	Locks the main unit to the trolley in case of loss.
8	Power inlet	Connects with the power adapter.
9	Serial port for connecting ECG	Connects the ECG Module .
10	HDMI	Used for extending the monitor.
11	USB ports	Connects USB devices.
12	Network port	Connects the network.

NOTE: Mindray recommends using Category 2-certified HDMI output cables (marked as “High Speed”) according to HDMI 1.3 standard for a good output effect. Otherwise, abnormal display effect may result. You can use a HDMI-to-DVI adapter for outputting to a display with DVI input.

When connecting TE7 with an external display or recording devices via HDMI, choose a right output setting resolution ([Setup] ->[System] ->[Peripheral] -> [Display]), and please make sure the scan rate of 60Hz progressive is supported by the external device, otherwise malfunction may result.

2.1.3 Trolley Appearance





No.	Name	Function
<1>	Main unit of ultrasound system	/
<2>	Trolley handle	Used for ascending/descending or moving the trolley.
<3>	Height lever	Press to adjust the height of the stand.
<4>	Storage bin	Used for keeping the cases, towelette, etc.
<5>	Caster	Used for securing or moving the system
<6>	Reader support	Used for fixing the barcode reader.
<7>	Main unit support	Used for fixing the ultrasound system.
<8>	Gel holder	Used for placing the gel.
<9>	Slot for organizing the cables	Used for organizing the probe cables and peripheral cables.
<10>	Towelette holster	Used for placing the towelette container.
<11>	Printer tray	Used for placing the printer.
<12>	Retractable cable	AC power supply cable. ⚠**CAUTION:** **DO NOT insert the fingers into the gap next to the plug in case of injury.**
<13>	Power outlet	Supplies the power for optional peripheral devices.

⚠WARNING:

1. **When you connect another device to this system, you should use the equipotential wire to connect each of equipotential terminals; otherwise electric shock may result.**
2. **Connect the earth cable before turning ON the system. Disconnect the earth cable after turning OFF the system. Otherwise electric shock may result.**
3. **DO NOT connect this system to outlets with the same circuit breakers and fuses that control the current to devices such as life-support systems. If this system malfunctions and generates over current, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.**

2.1.4 Peripherals Supported

The peripheral devices supported by the system. The information is shown as below:

No.	Item	Model
1.	Digital graph/text printer	HP Officejet 7000 wide format
2.	Black / white video printer(digital)	MITSUBISHI P95DW-N SONY UP-D897 SONY UP-D898MD SONY UP-X898MD
3.	Digital color video Printer	SONY UP-D25MD Cannon SELPHY CP800
4.	Barcode reader	SYMBOL DS6707-SR SYMBOL LS2208-SR
5.	External DVD R/W drive	ASUS DVD

NOTE: USB cable length of the printer should between 5 ft and 6 ft.

- Parts that can be used within patient environment:
  - Main unit;
  - Probes;
  - Footswitch;
  - Printers: MITSUBISHI P95DW-N, SONY UP-D897, SONY UP-D898MD, SONY UP-X898MD, Cannon SELPHY CP800 and SONY UP-D25MD.

NOTE: If the ultrasound system can not recognize the SONY UP-X898MD and SONY UP-D898MD printers automatically, you may need to change the settings on the printer: push <PUSH ENTER> to enter the main menu and select [DIGITAL]->[DRIVER], and select [897].

⚠WARNING:	**This device complies with IEC60601-1-2:2007, and its RF emission meets the requirements of CISPR11 Class B. In a domestic environment, the customer or the user should guarantee to connect the system with Class B peripheral devices; otherwise RF interference may result and the customer or the user must take adequate measures accordingly.**

2.2 Specifications

2.2.1 External Dimensions and Weight

- Dimensions: 97(Depth)×295(Width)×380(Height)mm
- Weight (including batteries, three-probe socket configuration and one probe): <8.2Kg.

2.2.2 Electric Specifications

2.2.2.1 AC IN

Voltage	100-240V~ 19Vdc（main unit direct input）
Frequency	50/60Hz (for adapter)
Output power	2.0A (Power adapter) 3.5A (Trolley)
Fuse	T5AL, 250Vac
Battery	14.8Vdc
Input current	407 VA

2.2.2.2 Battery

Main unit battery:

Voltage	14.8V
Battery capacity	5800mAh (one battery) x 2

2.2.3 Environment Specifications

	Operating conditions	Storage and transportation conditions
Ambient temperature	0°C~40°C	-20°C~55°C
Relative humidity	30%~85% (no condensation)	20%~95% (no condensation)
Atmospheric pressure	700hPa~1060hPa	700hPa~1060hPa

⚠WARNING:	**Do not use this system in the conditions other than those specified.**

2.2.4 Monitor Specifications

Working voltage	12V
Monitor size	15 inches
Resolution	768×1024
Visual angle	≥85°

3 System Installation

3.1 Installation Preparations

Note:	Do not install the machine in the following locations: Locations near heat generators Locations with high humidity Locations with flammable gases

3.1.1 Electrical Requirements

3.1.1.1 Requirements of Regulator

See *Chapter 2.2.2* for power supply specifications. Due to the difference of the power supply stability of different districts, please advise the user to adopt a regulator of good quality and performance such as an on-line UPS.

3.1.1.2 Grounding Requirements

The power cord of the system is a three-wire cable. The grounding terminal should be connected with a power grounding cable to ensure that protective grounding works normally. Make sure that the protective grounding works normally.

⚠WARNING:	**DO NOT connect this system to outlets with the same circuit breakers and fuses that control the current of devices such as life-support systems. If this system malfunctions and generates an over-current, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.**

3.1.1.3 EMI Limitation

Ultrasound machines are susceptible to Electromagnetic Interference (EMI) from radio frequencies, magnetic fields, and transient in the air wiring. They also generate EMI. Possible EMI sources should be identified before the unit is installed.

These sources include: medical lasers, scanners, monitors, cauterizing guns and so on. Besides, other devices that may result in high frequency electromagnetic interference such as mobile phone, radio transceiver and wireless remote control toys are not allowed to be presented or used in the room. Please turn off those devices to make sure the ultrasound system can work in a normal way.

3.1.2 Installation Condition

3.1.2.1 Space Requirements

Place the system with the necessary accessories at a proper position for convenient use.

1. Place the system in a room with good ventilation or having an air conditioning unit.
2. Maintain a generous – free air flowing space around the back and both sides of the system; failure may result due to increased rise in system operating temperature.
3. A combination lighting system in the room (dim/bright) is recommended.
4. Except the receptacle dedicated for the ultrasound system, at least 3-4 spare receptacles on the wall are available for the other medical devices and peripheral devices.
5. Power outlet and place for any external peripheral are within 2m of each other with peripheral within 1 m of the unit to connect cables.

3.1.2.2 Network Environment

Both wireless and wired LAN functions are supported by this ultrasound device.

Data transmission is allowed between different departments or areas without network cable. Network can be automatically connected after disconnection in case that the device is required to be moved, wireless transmission task can be recovered after the network resumed to normal condition. Confirm the network devices and network conditions before the installation.

1. General information: default gateway IP address, and the other routers related information.
2. DICOM application information: DICOM server name, DICOM port, and IP address.

3.1.3 Installation Confirmation

Please confirm the following items before installation:

- The video format of installation area or country.
- The language of installation area or country.
- Power frequency of installation area or country.
- The universal obstetrics formula and other measurement formula of installation area or country.
- The preset values of installation area or country that are different from the default values.
- The doctor’s operation habits.
- The items above prior to the installation training, and do the system settings according to the universal setting of installed region or country.

3.2 Unpacking

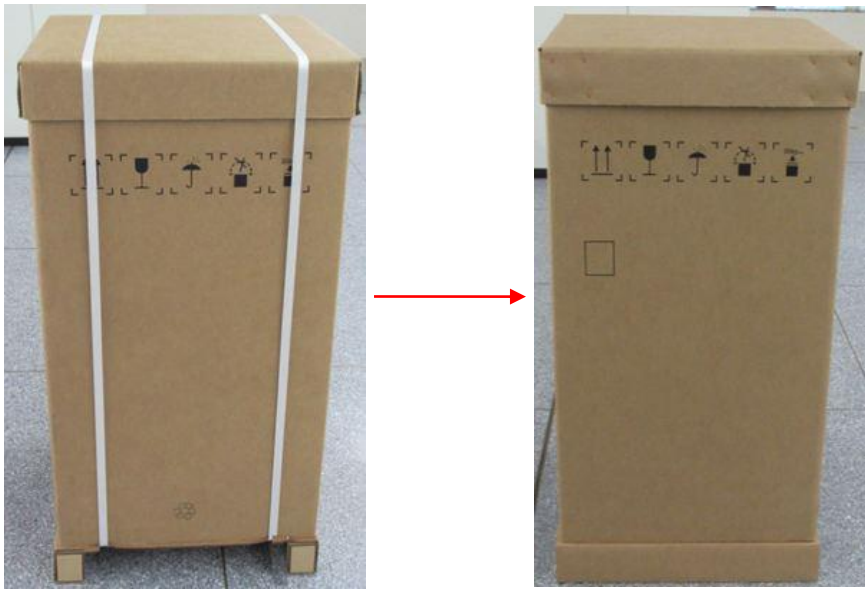
Unpacking tool: scissor

Installation duration: 1 people, 10 minutes.

3.2.1 Unpacking Process

3.2.1.1 Trolley Unpacking

1. Cut through the white straps on the package, as shown in the following figure:



2. Take off the lid on the box.

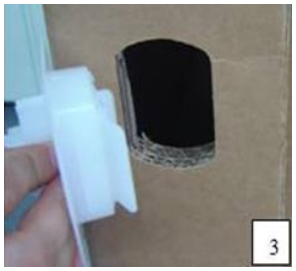
3. Remove the foam.

4. Remove the outer box

- Remove the box upwards if the space is commodious enough;
- If the space is not commodious enough, please follow the instructions below:
  Press the middle of plastic clasp on the one side of the box as shown below;

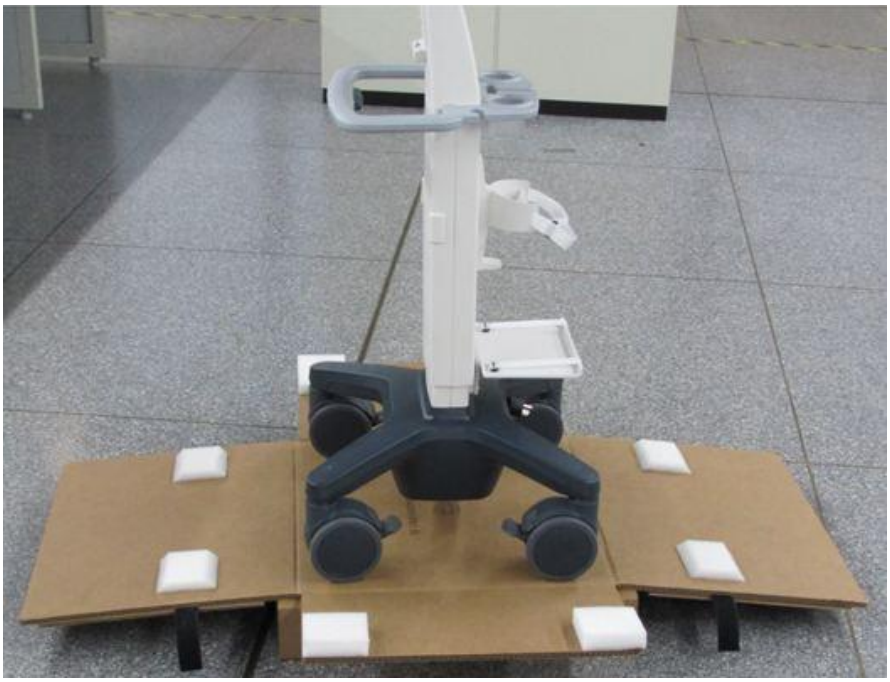
Pull the plastic clasp outward;

Then pull the whole plastic clasp out of the box (total of 4 plastic clasps);



To remove the cardboard, unfold it outwards after removing the plastic clasps.

5. Unfold the remaining cardboard box and push down the trolley.

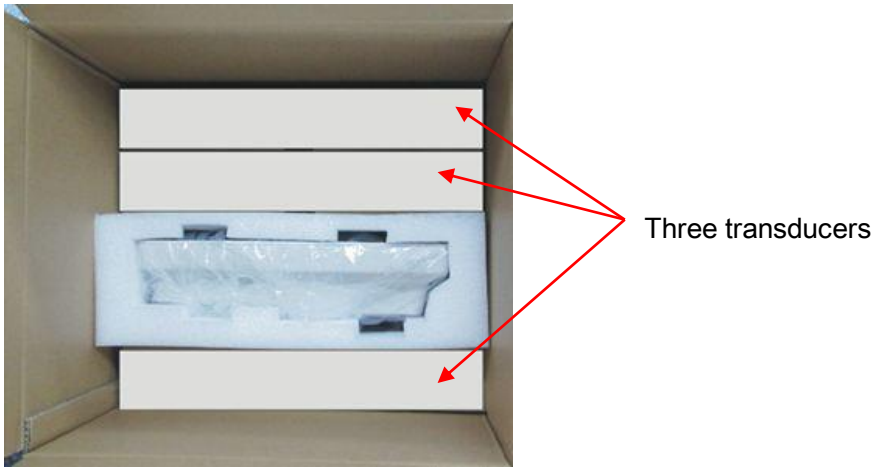


3.2.1.2 Main Unit Unpacking

1. To open up the packaging box, cut through the straps on the box.
2. Remove foam.

3. Take out the accessories and packing foam.

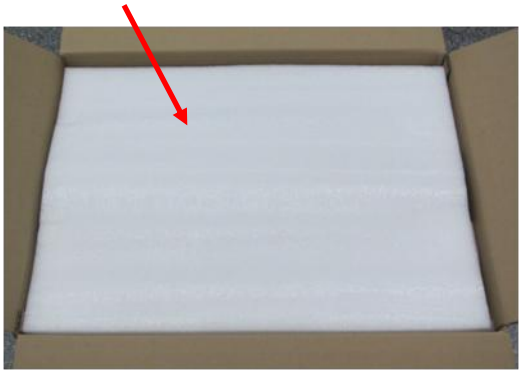
4. Take out the main unit and the transducers.



3.2.1.3 Travelling Case Unpacking

1. Clip the strips packing the carton and open the carton;
2. Take the foam plate out;

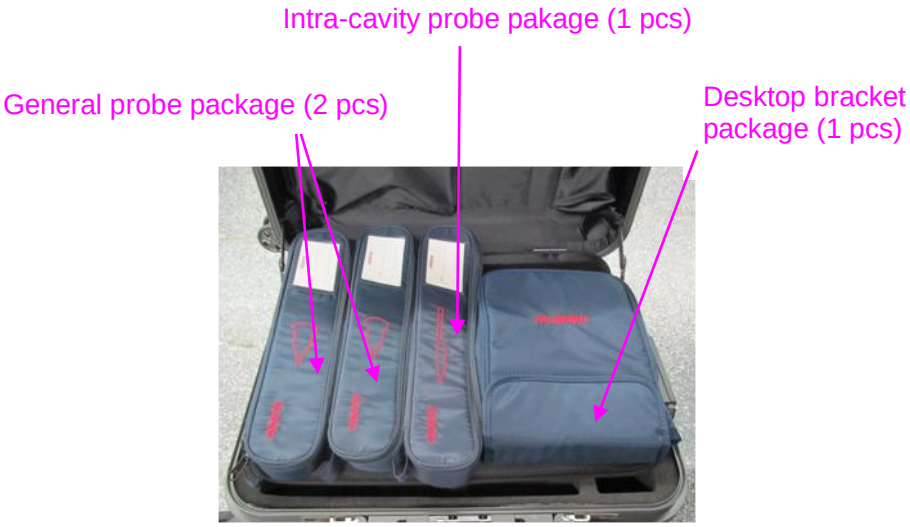
Foam plate(1 pcs)



3. Take the travelling case out.

4. Place the case with bottom up on the floor, push the buttons of the two lock on the front and pull the buckles out to release the locks and open the case.

5. Take out the probe packages and desktop bracket package.



3.2.2 Check

1. After unpacking, check the objects in the container with the package list to see if anything is in short supply or is wrong.
2. Inspect and make sure there is no damage to the machine, no indentation, no cracks. If there is, please contact Mindray Customer Service Department.

3.3 Installation of Whole Device

3.3.1 Connecting Power Cable

1. Connect the connector of the power adapter to the adapter port in the system.
2. Use a three-wire cable to connect the adapter with the external power supply.
3. The external power supply must meet the requirements in chapter “2.2.2 Electric Specifications”.

If you have any question about the power adapter, please contact your sales representative.

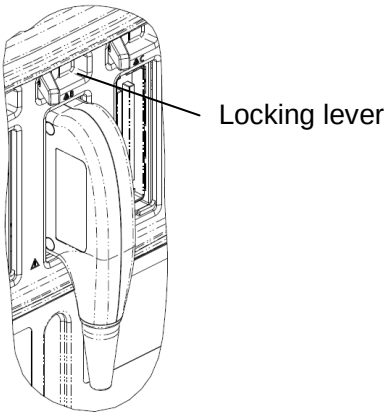
NOTE:	You must use the specified power adapter. Do not use this power adapter in the conditions other than those specified.

3.3.2 Connecting a Ultrasound Probe

⚠WARNING:	**The probes, cables and connectors are in proper operating order and free from surface defects, cracks and peeling. Using a defective probe may cause electric shock.**

1. Keep the cable end of the transducer to the right side of the system; insert the connector into the system port, then press in fully
2. Toggle the locking lever to the left position.

3. Position the probe properly to avoid it being treaded on or becoming wrapped around other devices. DO NOT allow the probe head to hang free.



NOTE:	Before inserting the connector into the probe port, inspect the connector pin. If the pin is bent, do not use the probe until it has been inspected/repaired/replaced.

3.4 Installing Peripherals

Please see *Chapter* 2.1.4 for the device model that the system supports.

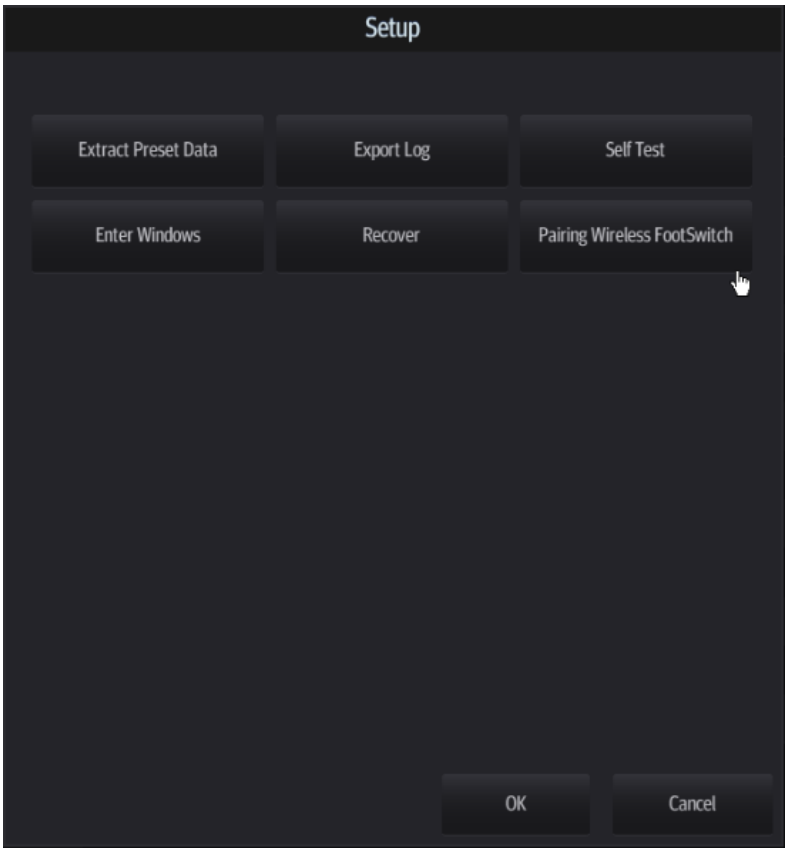
3.4.1 Connecting the Footswitch

⚠**WARNING:**	DO NOT connect more than one wireless footswitch receiver to the ultrasound system at the same time; otherwise, malfunction may result.

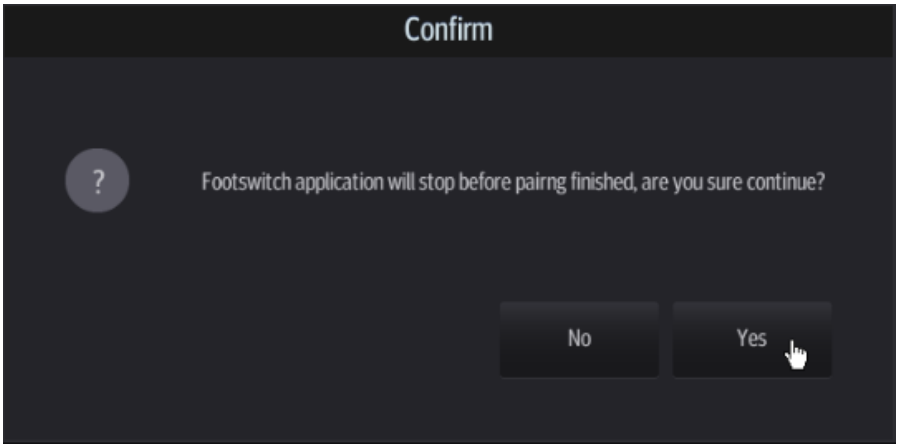
The system supports USB port-type footswitches (1-pedal, 2-pedal and 3-pedal) and wireless type footswitches (2-pedal and 3-pedal).

- Wireless footswitch setting

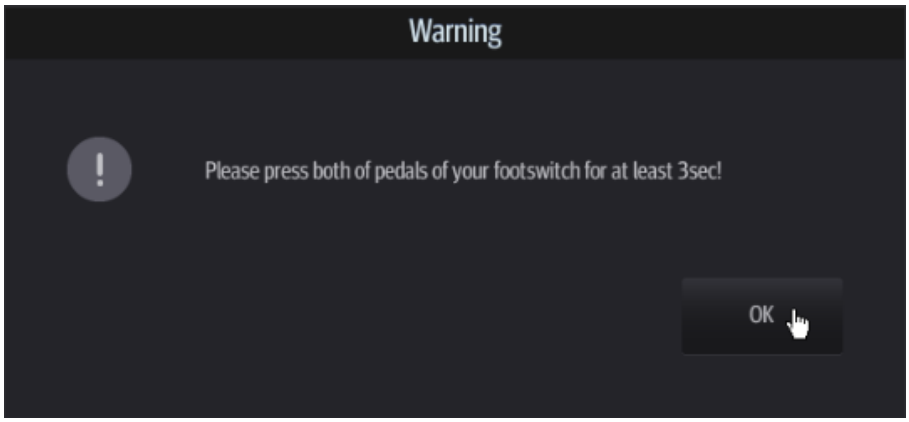
1. Connect one wireless footswitch receiver to the ultrasound system.
2. Tap in the top-right corner of the screen and select to enter the setup menu. Click [Maintenance] → [Setup] → [Pairing Wireless FootSwitch] to pairing wireless footswitch.



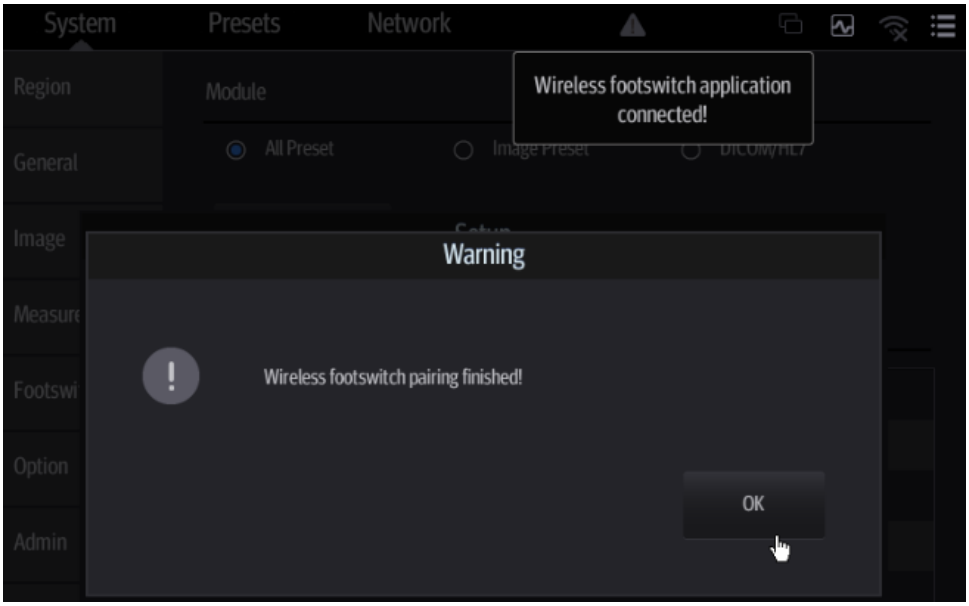
3. "Confirm" dialog box will pop up; and click [Yes] as shown in the following figure.



4. "Warning" dialog box will pop up, which prompts “Please press both of pedals of your footswitch for at least 3sec!” as shown in the following figure.



5. Press both of pedals of your footswitch for at least 3sec until “Wireless footswitch application connected!” is displayed on the right upper corner of screen. "Warning" dialog box will pop up, which prompts “Wireless footswitch pairing finished!” as shown in the following figure, click [OK].



6. Click [Footswitch] to assign a function to the left/middle/right key of the foot switch. Press the corresponding pedals of footswitch to use the function.

- USB port-type footswitch setting

1. Connect USB port-type footswitch to the ultrasound system.
2. Click [Footswitch] to assign a function to the left/middle/right key of the foot switch.

3.4.2 Connecting/Removing a USB Devices

⚠WARNING:	**DO NOT directly remove a USB memory device; otherwise, the USB device and/or the ultrasound system may be damaged.**

- When connecting a USB memory device to the ultrasound system via a USB port, a sound is heard if it is connected successfully and the symbol appears in the top-right corner of the screen.
- To remove the USB device: click to open the [Remove USB Device] screen. Select the device to be removed and tap [OK]. A sound is heard when removing the USB memory device.
- The system supports option of external DVD R/W drive. The DVD R/W drive is connected to the ultrasound system via USB port.

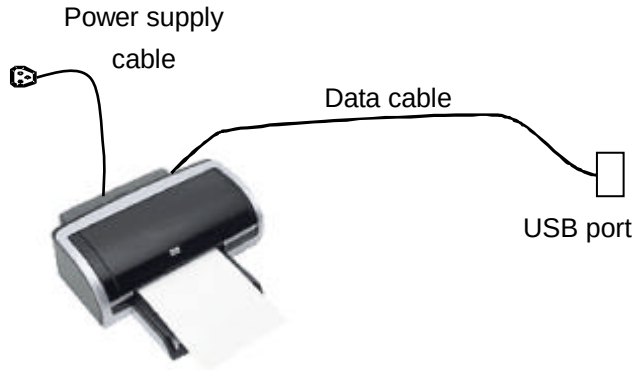
NOTE:	If the USB disk cannot be recognized by the system, please try disconnecting and then connecting again several times, or try another USB disk. If the problem still exists, please contact Mindray service engineer.

3.4.3 Graph/Text Printer

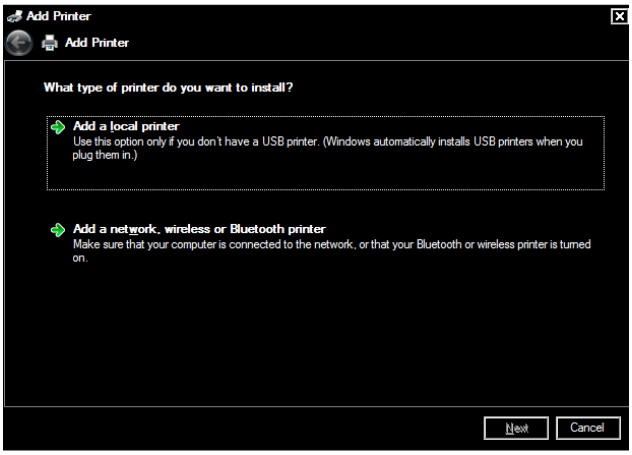
- Connecting a local printer

  Note: Printers listed in *Chapter* 2.1.4 have drivers installed already.

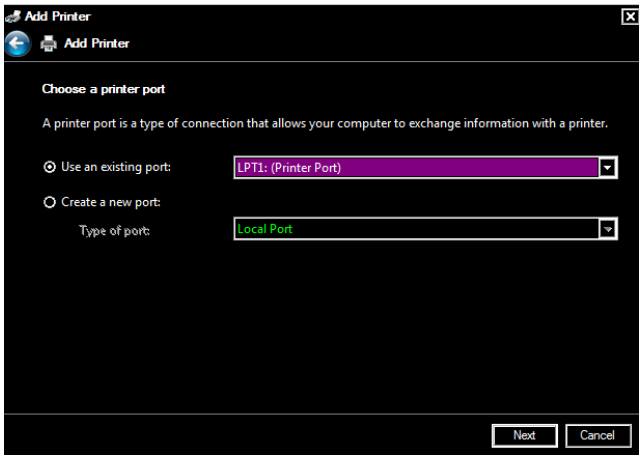
  As shown in the figure below, a graph / text printer has a power cord and data cable. The power cord shall be directly plugged into a well-grounded outlet.



1. Connect the data cable to the USB port on the ultrasound system.
2. Power the system and the printer on.
3. Put the installation optical disk of the printer driver into the external DVD R/W drive.
4. Install the printer driver: Select [Setup] → [Print Preset] → [Add Printer].

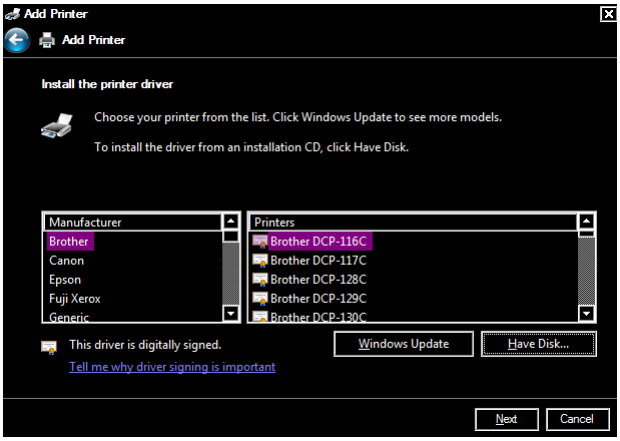

Add Printer
Add Printer
What type of printer do you want to install?
Add a local printer
Use this option only if you don't have a USB printer. (Windows automatically installs USB printers when you plug them in.)
Add a network, wireless or Bluetooth printer
Make sure that your computer is connected to the network, or that your Bluetooth or wireless printer is turned on.
Next
Cancel

5. Select [Add a local printer] and tap [Next] to enter the screen used for browsing driver.


Add Printer
Add Printer
Choose a printer port
A printer port is a type of connection that allows your computer to exchange information with a printer.
Use an existing port:
LPT1: (Printer Port)
Create a new port:
Type of port:
Local Port
Next
Cancel

Note: see the printer's operation manual to select the port, or try to use the default port of the system.

6. Tap [Have Disk] to find the driver path (the installation type should be WIN7 64), and then tap [Next] to install the driver.



7. Complete the operation according to the tips on the screen. Tap [Finish] to end the installation.

■ Add network printer

1. As the system is connected into a LAN, open [Setup] -> [System] -> [Peripheral] screen.
2. Tap [Add Printer], select [Add a network, wireless or Bluetooth printer].

3. The system starts to search all available printers within the network. Select the target printer and tap [Next], the system tries to connect to this printer.
4. When the connection is successful, the system prompts the dialogue box, tap [Next] according to the screen tips and then tap [Finish].The printer is installed successfully.

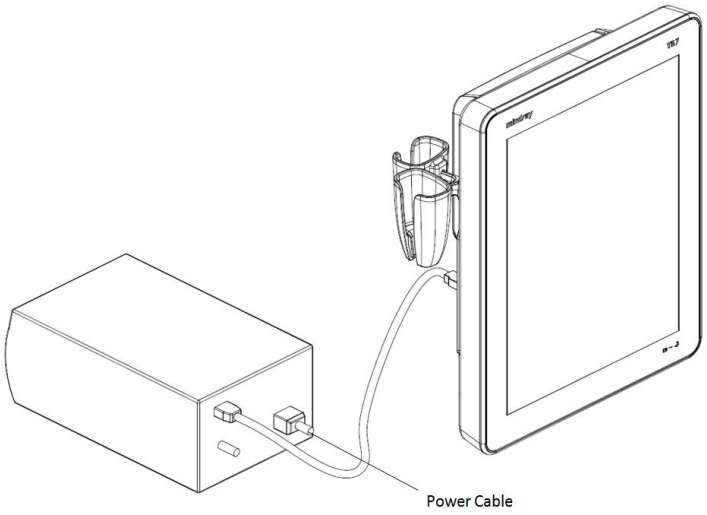
Tips: the system has combined many types/brands of printer drivers, if targeted printer drive is not included in the system, you may need to install the driver for the network printer. Please use the optical disk or USB flash drive with the driver to install according to the system prompts.

NOTE:	When you install the printer's driver, you must specify the specific path for installation. A vague path may result in longer searching times. The network printer functions depending on the configured network environment in the hospital, please consult the network configuration manager in case of failure.

Please refer to the accompanying manuals of the printers for more details.

3.4.4 Video Printer

The system support video printers, consist of the B/W digital printers and color digital printers.



1. Position the printer in the proper place.
2. Plug the printer power cord into an appropriate outlet.
3. Use a USB cable to connect between the system's USB port and the printer's USB port.
4. Load a paper roll, and turn on the system and printer.
5. See section "3.4.3 Graph/Text Printer" for the driver installation procedure (printer drivers listed in chapter "2.1.4 Peripherals Supported" are installed already).

3.4.5 Barcode Reader

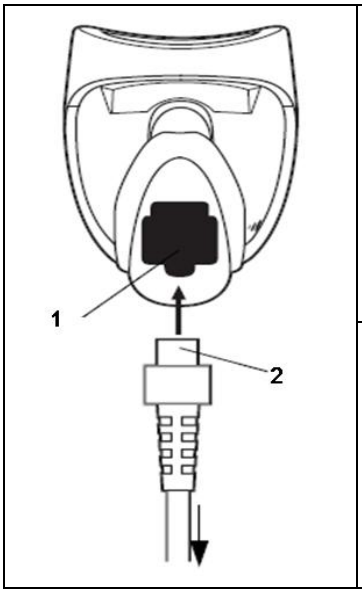
The system supports barcode reader to read the patient information (ID).

3.4.5.1 1-D Barcode Reader

1. The appearance of barcode reader. Each part of the barcode reader: LED indicator, scan window and scan trigger button.

1.	LED indicator	Green light is on if scan is successful. Red light is on if the scan fails.
2.	Scan window	Scan the barcode.
3.	Trigger	Tap to decode

2. Plug connecting terminal of the cable to the port of the barcode reader. Ensure the contact works well.
3. Connect USB terminal of the connecting cable to the USB port of main unit.



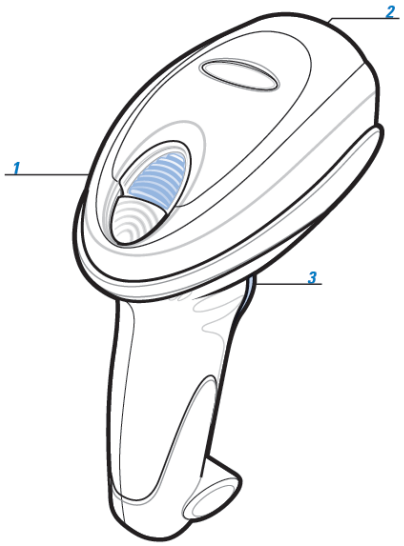
1.	Barcode reader port
2.	Connecting terminal of connecting cable

4. Press scan trigger button to receive barcode when ultrasound device is running (without installing driving program). For more operation details, see relevant barcode reader manual.

3.4.5.2 2-D Barcode Reader

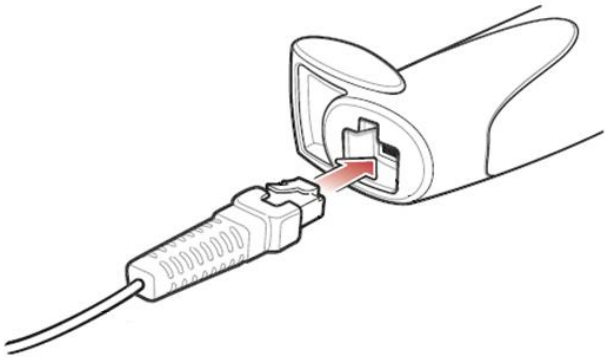
- Install the connecting cable

1. The appearance of barcode reader. Each part of the barcode reader: LED indicator, scan window and scan trigger button.



1.	LED	Green: A barcode was successfully decoded. Red: A data transmission error or reader malfunction occurred.
2.	Scan window	Scan the barcode.
3.	Trigger	Tap to decode

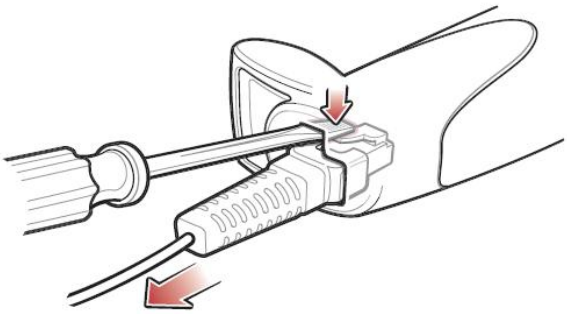
2. Plug connecting terminal of the cable to the port of the barcode reader. Ensure the contact works well.
3. Connect USB terminal of the connecting cable to the USB port of main unit.



4. Press scan trigger button to receive barcode when ultrasound device is running (without installing driving program). For more operation details, see relevant barcode reader manual.

■ Disconnect the connecting cable

1. Using the tip of a screwdriver or some other tools with a sharp head, depress the cable's modular connector clip.



2. Carefully slide out the cable.

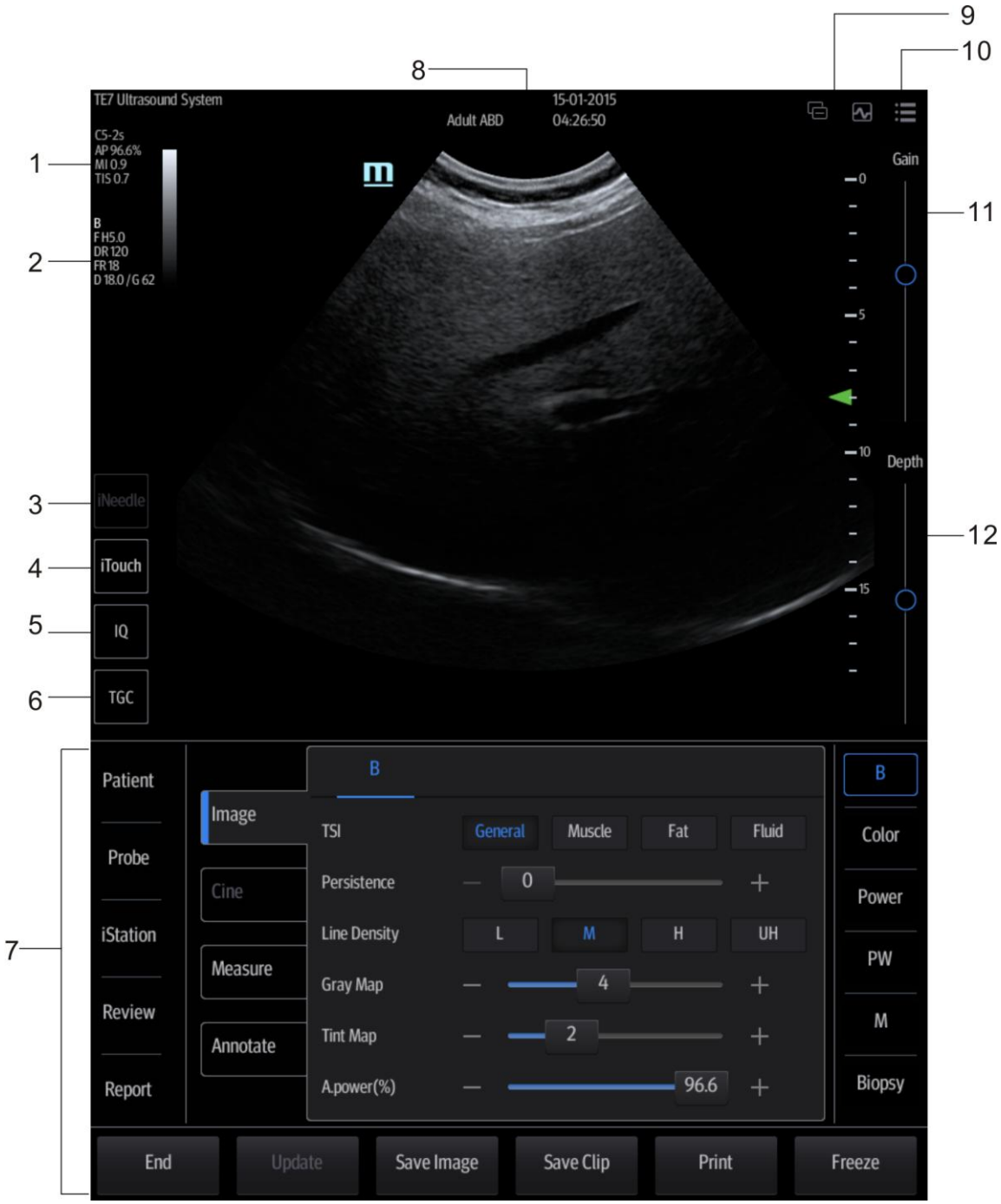
3.5 System Configuration

3.5.1 Power-on Running

Connect the connecting terminal of the power adapter to the adapter port in the system. Use a three-wire cable to connect the adapter with the external power supply. Ensure the connection of ultrasound and optional device works well.

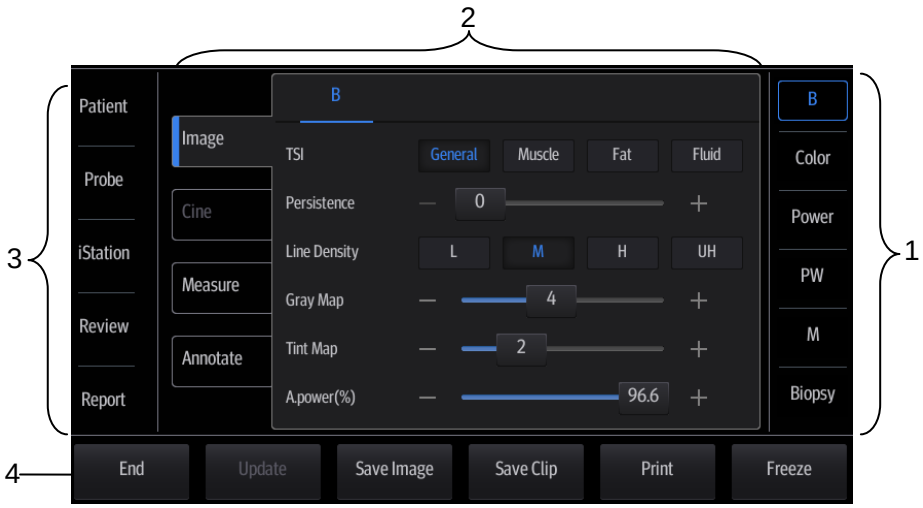
3.5.2 Enter Doppler

After the initialization process (about 1 minute), the system enters Doppler interface, as shown below:



1.	Probe model, acoustic output value and MITI index	2.	Parameter area
3.	iNeedle	4.	iTouch
5.	Frequency adjustment	6.	TGC control
7.	Operating panel	8.	Patient Information area
9.	System status icon	10.	System tool bar
11.	Gain control	12.	Depth control

■ Operating panel



Operating panel locates under the image area; consist of imaging mode buttons, menu area and exam related buttons.

1. Imaging mode area

   Tap imaging buttons to start imaging.

2. Menu area

   - Imaging parameter menu: swipe the menu downwards/upwards to see parameter controls;
   - Cine review menu (under frozen or cine review status);
   - Measurement menu;
   - Annotation and body mark menu.

3. Exam operating area

   Tap each button to enter the screen.

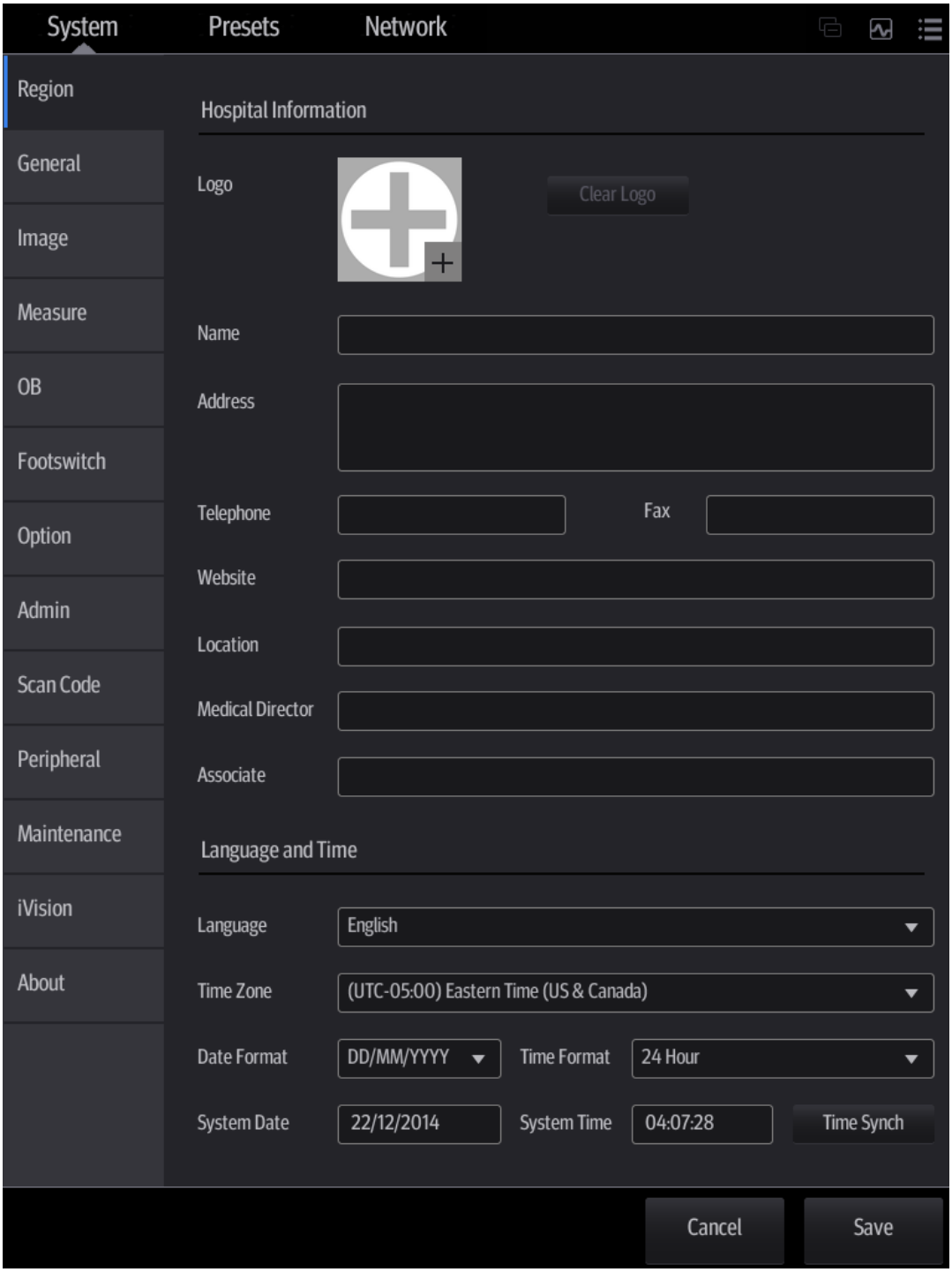
   - Patient information;
   - Exam mode and probe switching;
   - iStation;
   - Image review;
   - Report review.

4. Other buttons

   You can end exam, switching modes, save an image/cine, print single frame image or freeze/defreeze image, etc.

3.5.3 System Preset

1. Tap in the top-right corner of the screen and select to enter the setup menu.



2. The system automatically enters the [System] screen after you enter Setup.

   Select each tab to enter the further detailed setting for each mode. The following gives a brief introduction of each page, see the following chapters for details.

Page	Description
Region	To set the hospital name, language, time zone, time format and system date/time, Time Syrch.
General	To set patient information, exam, patient management, storage related parameters, system dormancy, annotation and body mark and so on.
Image	To set general parameters in imaging modes.

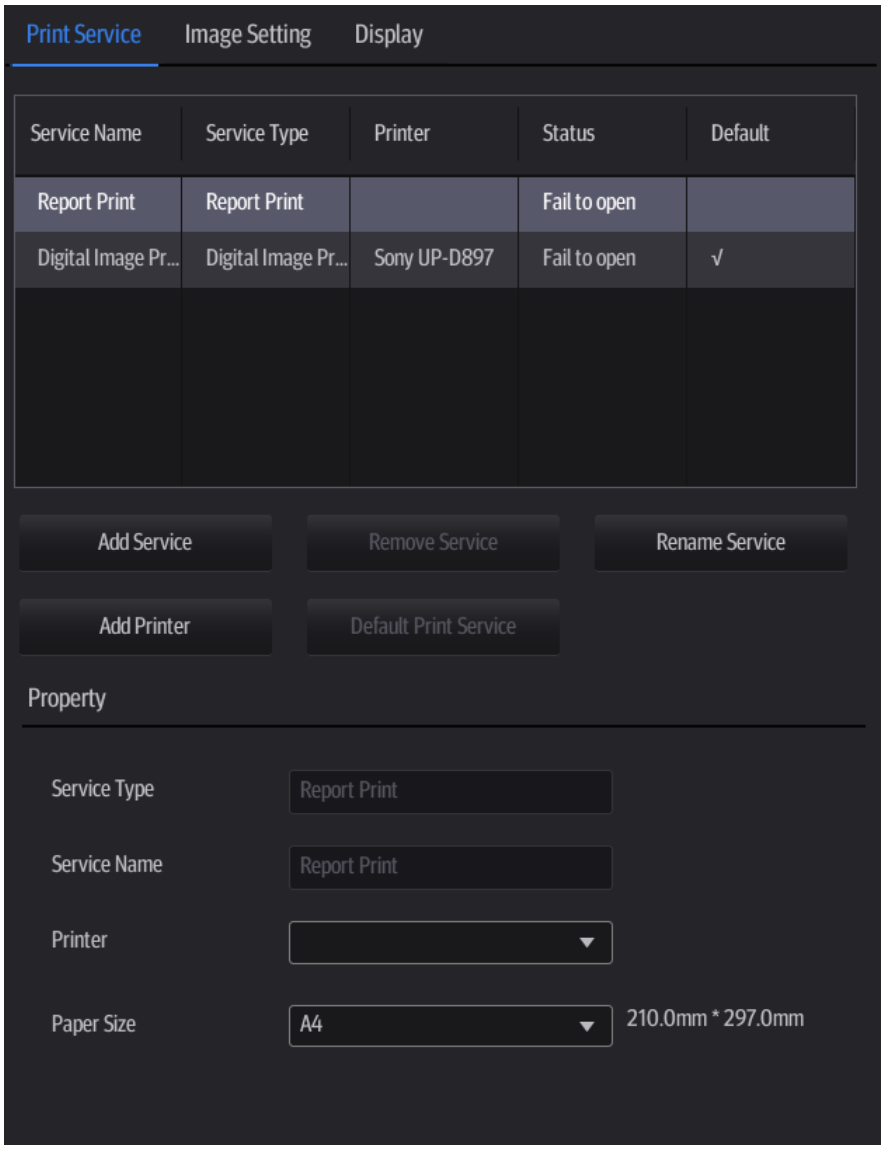
Page	Description
Measure	To set the measurement ruler, measurement setting, follicle method and so on.
OB	To set the relevant information regarding the fetal gestational age and fetal weight.
Footswitch	To assign functions to the footswitch.
Option	To check installed options and you can also install/trial options that are not installed yet. You can trial each option for 3 months at most. Each option can only be trialed once. If you have any questions, please contact the service engineer or your agent.
Admin	To set the user account control relevant information.
Scan Code	To set the code parameters for barcode reader.
Peripheral	To set printer and display parameters.
Maintenance	To import or export user data, restore factory setting and export log.
iVision	To set iVision related parameters and perform demonstration.
About	You can check system versions and information here.

3.5.4 Peripheral Preset

This screen is used to set up the printer and image printing.

- Printer setting

  The printer settings include print service and print driver.



- Print Service Setting
  - ➢ Add Service: click to begin adding print services.
  - ➢ Remove Service: click to delete the selected print service.
  - ➢ Rename Service: click to rename the selected print service.
  - ➢ Default print service: click to set the selected print service as the default one.
  - ➢ Property: to preset print service properties.

  For details about adding printers, see “3.4.3 Graph/Text Printer.”

■ Image Settings

Tap [Image Setting] to enter the page, you can set the brightness, contrast and saturation of image printing, or you can use the default values.

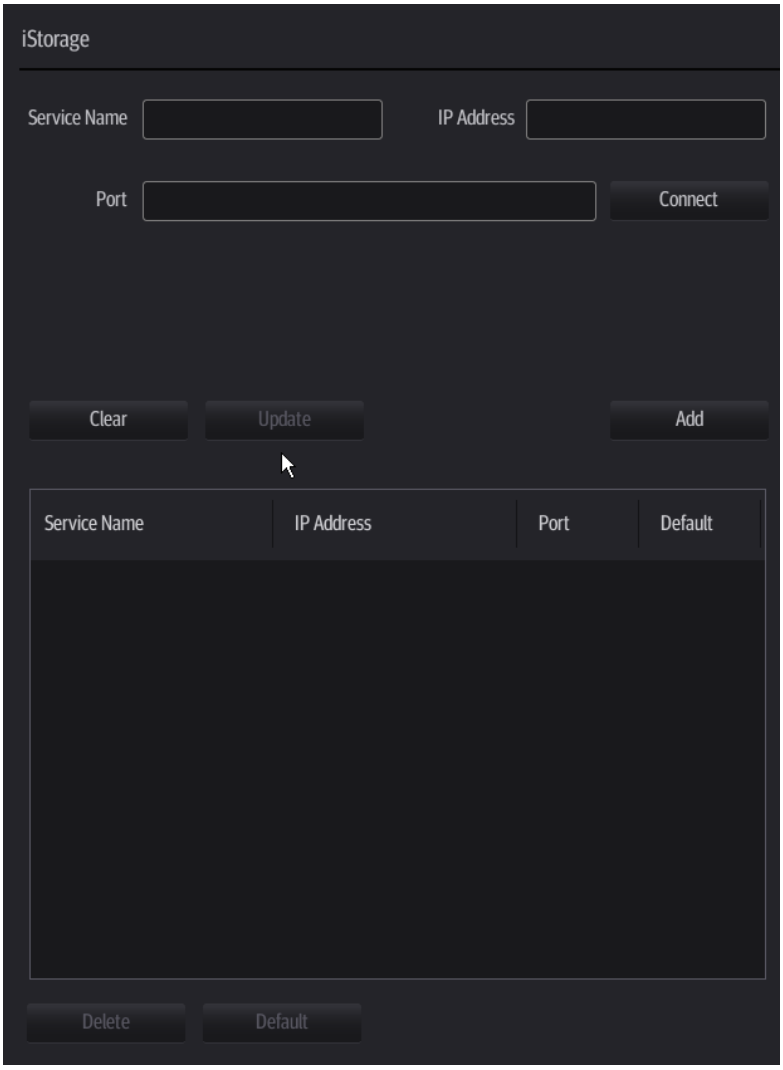
■ Display

Tap [Display] to enter the page, you can set output resolution and range for the connected external display.

3.5.5 Network Preset

3.5.5.1 iStorage Preset

- The iStorage screen is as follows:



Name	Description
Service Name	The name of the iStorage service.
IP Address	IP address of the iStorage service device.
Port	Port for transmitting.
Connect	Click to verify connection.
Clear	Clear the information that is being typed in.
Add	Click to add the Network service to the service list.
Update	To save the changed parameters.
Delete	Click to delete the selected service from the service list.

- Add an iStorage service

1. Set the iStorage server properties as described above.
2. Tap [Add] to add the service to the Service list.

- Modify a network service

1. Select the service to be updated in the service list.
2. You can see properties in the Configure Service area.
3. Modify the parameters and tap [Update] to update the setting.

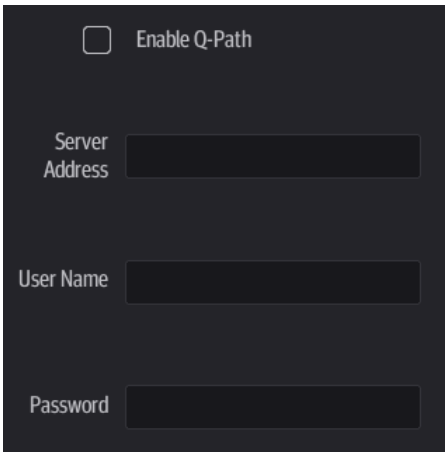
3.5.5.2 Q-Path

NOTE:	When logging on the Q-path service, the ultrasound system is connected to the external network and it may be infected by virus. Please do not access the unrelated website or perform any unrelated operations. If abnormal data or link is discovered after logging on the Q-path service, please stop operation and contact the Q-path service provider.

You can use the ultrasound system to check data on browser directly. After you have ordered storage service of a network website service, you can check data using the website, authorized account and password (provided by the service vendor).

Q-path is a network server provided by Telexy Healthcare Inc. for digital image storage. For details, please contact Q-Path service provider.

1. Set related setting in the path: [Setup] -> [Network] -> [Q-Path].
   a) Select "Enable Q-Path" in the path;
   b) Enter the website, account and password of the target service.



2. Tap [Save] to exit Setup screen.
3. Select from the system tool bar in the top-right corner of the screen.

   Tips:

   If network connection is not normal, the system will prompt “Loading Q-path application, please wait....”

   The following prompt may display every time you enter Q-Path after powering on the machine. If you see this information, select "Yes" to enter the website service.

4. Tap X to exit the function.

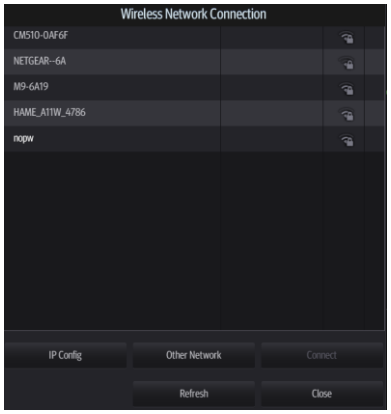
NOTE:	If you use Q-Path function to connect to websites other than Q-Path applications (website setting is described above), the system will prompt the following information: Only Q-Path application is allowed to be loaded!

3.5.6 DICOM/HLP Preset

3.5.6.1 IP Preset

- Wireless LAN

  1. Tap in the top-right part of the screen to open the wireless network manager.



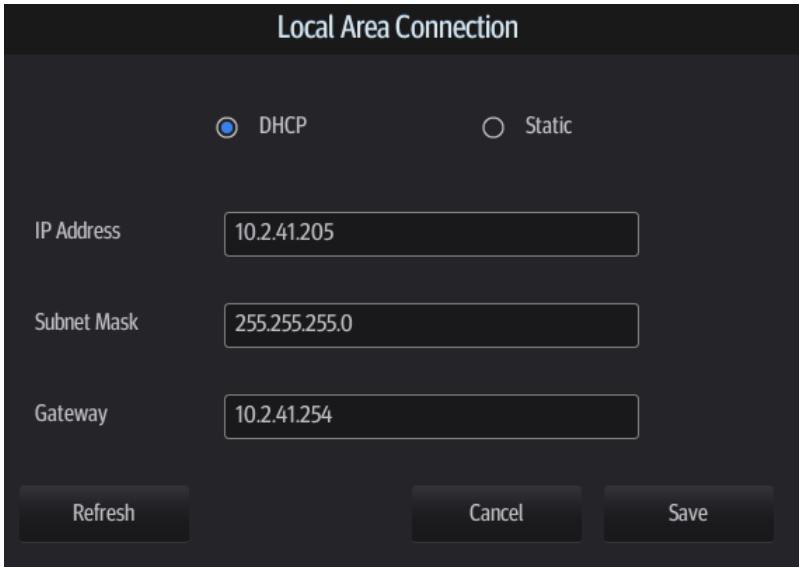
  2. Tap to select the target network, tap [Connect] to connect to the network.

     When connecting an encrypted network, enter the password in the box first. You can select to hide password characters or not.

  3. The system tries to connect to the selected network. The icon turns into after successful connection.

- wired network connection

  If wired network connection is used, please follow the below steps to do the configuration.

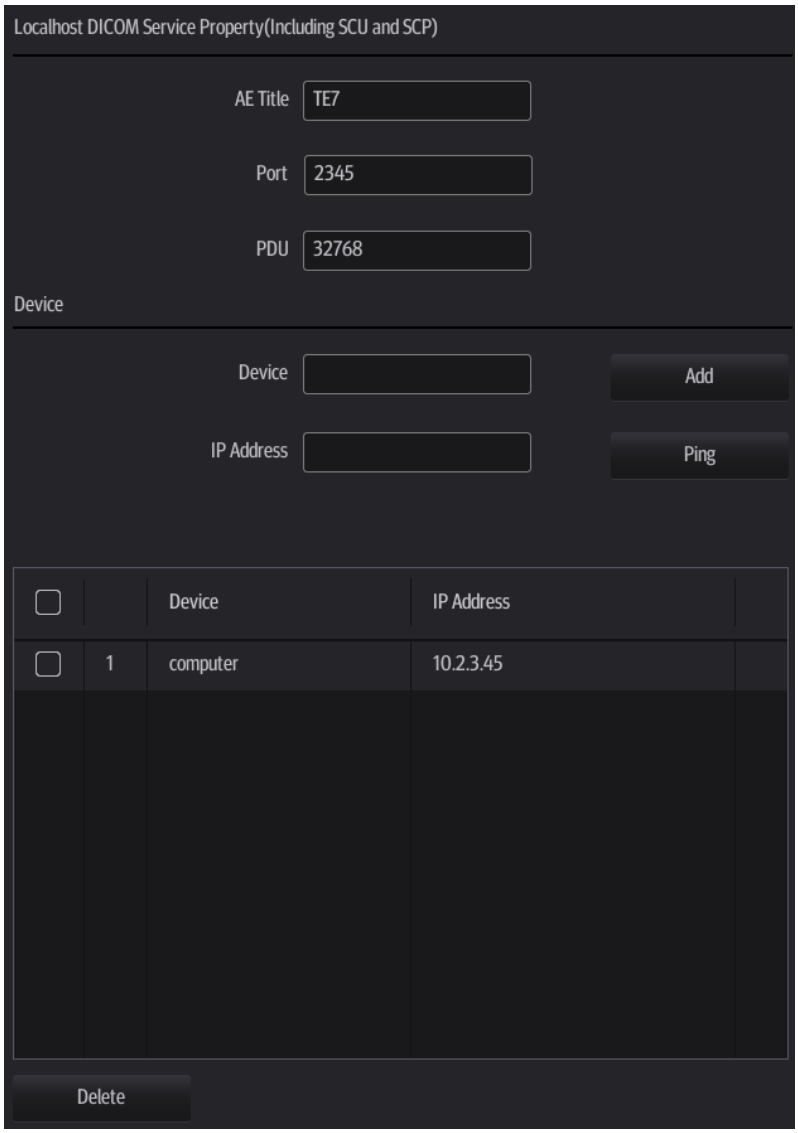


1. Tap in the top-right part of the screen to open the local connection dialogue box.
2. Select DHCP/ Static for the network.
3. Tap [Save] to exit the dialogue box after finishing the setting.

3.5.6.2 DICOM Local Preset

Note:	Only if DICOM basic option is configured, [DICOM Preset] is available.

1. Enter the DICOM local preset screen using the path: [Setup] -> [Network].
2. Enter AE Title, Port and PDU according to the actual situation, then tap [Save] to exit the screen. Setting items are introduced in the following.



Name	Description
AE Title	Application Entity title.
Port	DICOM communication port.
PDU	Maximum PDU data package size, ranging from 16384 to 65536. If the value is less than 16384 or greater than 65536, the system automatically sets it to the value 32768.
Device	Name of the device supporting DICOM services.
IP Address	IP address of the server.
Ping	You can ping other machines after entering the correct IP address. You can also select a server in the device list below to ping it.
Add	Select to add servers to the device list.
Delete	Select to delete selected servers from the device list.

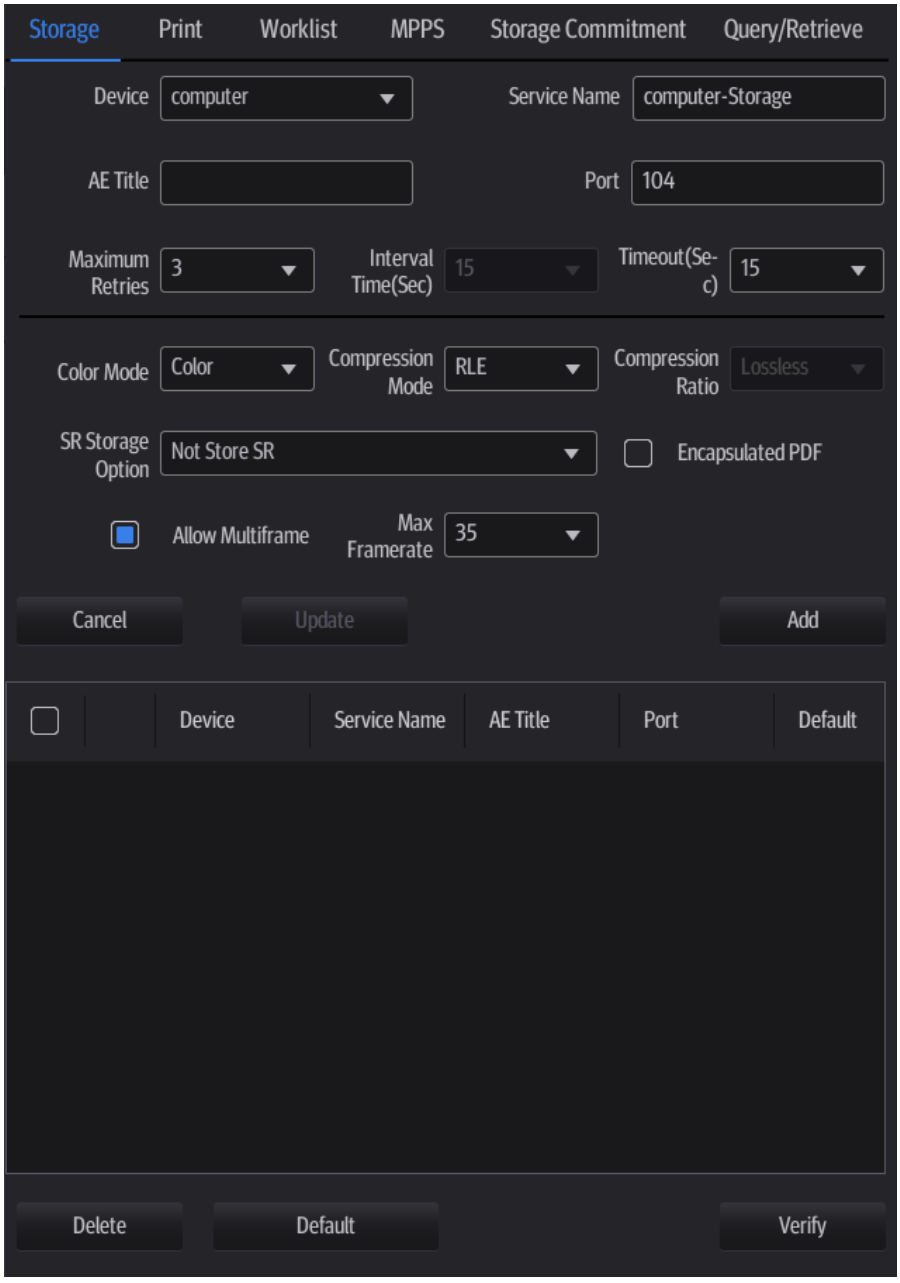
■ Server setting procedure:

1. Enter the server device name and IP address. Tap [Ping] to check the connection.
2. Tap [Add] to add the server to the device list. Its name and address are displayed in the list.

Tip:
The AE Title should be the same as the SCU AE Title preset in the server (PACS/RIS/HIS). For example, if the AE Title of the server preset in the storage server is Storage, and the AE Title of the accepted SCU is preset as Machine, then in the figure above, the AE Title of Local should be Machine, and the AE Title of the storage server should be Storage.

3.5.6.3 Storage Service Preset

1. On the DICOM/HL7 screen, select the [Storage] page tab to enter the Storage page.
2. Select a device and enter the correct AE Title, port, etc.
3. Tap [Add] to add the service to the Service List.



DICOM storage preset items are described as follows:

Name		Description
Configure New Service	Device	After setting the servers in the DICOM local screen, the names will appear in the drop-down list. Select the name of the storage server.
	Service Name	The default is xxx-Storage, user-changeable.
	AE Title	Application Entity title. It should be consistent with that of the storage server.
	Port	DICOM communication port, 104 is the default. The port should be consistent with that of the storage server port.
	Maximum Retries	Set the maximum retries.
	Interval Time(Sec)	Reserved.
	Timeout (Sec)	Refers to the amount of time after which the system will stop trying to establish a connection to the service.
	Color Mode	Select the color mode.
	Compression Mode	Select the Compression mode: uncompressed, RLE, JPEG and JPEG2000.
	Compression Ratio	Select the JPEG Compression ratio: lossless, low, medium and high.
	Allow Multiframe	If SCP supports this function, select it.
	Max Frame Rate	Set the frame range for transferring cine files to DCM multi-frame files.
	SR Storage Option	Select structured report sending options.
	Encapsulated PDF	Select whether to encapsulate PDF format reports in DICOM standard.
	Add	Add the DICOM service to the service list.
	Cancel	Select to cancel parameter setting.
	Update	Select an item in the service list, change the parameters in the above area, and tap [Update] to update the item in the service list.
Service List	Delete	Select to delete the selected service from the service list.
	Default	Select an item in the service list. Tap [Default] and you will see “Y” in the Default column.
	Verify	Select to verify that the two DICOM application entities are properly connected.

Tip: RLE, JPEG and JPEG2000 are not supported by all SCPs. Refer to the SCP's DICOM CONFORMANCE STATEMENT electronic file to check whether SCP supports it or not. Do not select these Compression modes if the storage server does not support them.

- Images of PW/M mode (B image is not frozen) and images other than PW/M mode: if “Max Frame rate” is not “Full” and the actual frame rate is larger than the set value, the system will save the image files in a frame rate of the set value, and transfer in a frame rate of B mode.
- Images of PW/M mode (B image is frozen), the system will save/transfer the images files in frame rate of 6.

3.5.7 System Information Verification

This screen displays the system software version and versions of other devices. You cannot edit the information, only view them. The information varies depending on the system configurations and version.

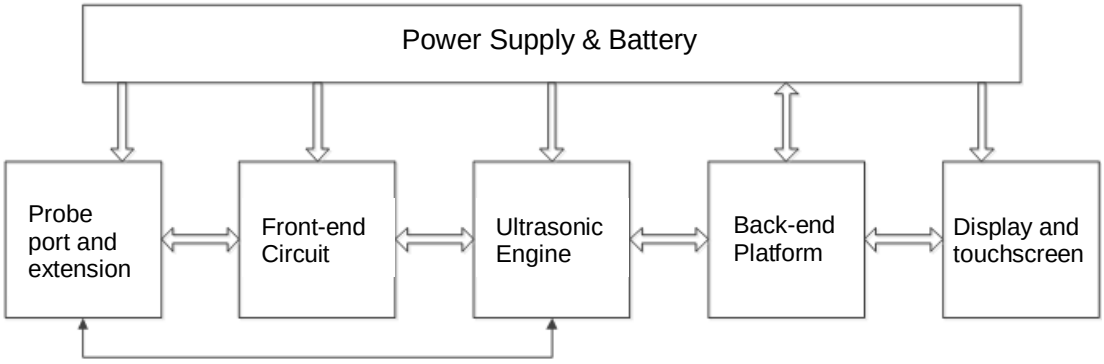
Note:
1. Confirm the system information before and after the software maintenance.
2. If required, the system reminds the user of saving the current system information.

4 Product Principle

4.1 Function Structure of Hardware System

Main unit (Display Control Unit):

- Probe port and extension
- Front-end Circuit
- Ultrasonic Engine
- Back-end Platform
- Interactive interface (display and touchscreen)
- Power Supply & Battery



Picture 1 Hardware System Diagram

4.1.1 Probe Socket

The probe socket can be achieved on this board as well as the extension of multi-probe.

- It supports the configurations of single probes and triple probes. The function of the three-probe keeps the same.
- The probe socket offers 128-array channels.
- It supports TEE probe.
- It supports 192-array probe.
- It supports bi-planar probe.
- It provides the switching channel between 128-array port and 64-receiving channel.

4.1.2 Front-end Circuit

It provides physical platform of the transmission and receiving for the entire system, which consists of the transmission/receiving/clock circuit.

- It provides 64-channel transmitting/receiving circuit.

- It supports the 5 emission level.
- It supports CW, and CW transmission of maximum 32-channel.
- 160 M system clock.
- 40 M sampling clock

4.1.3 Ultrasonic Engine

- It provides beam-forming of numeric-field data.
- It provides the processing of some signals after the beam is formed.
- It provides the scanning control.
- It provides signal channel (bus) which transmits and receives FPGA.
- It provides the data caching.
- It provides the signal channel (bus) of main console on the back-end.
- It provides switching function of 64/128 channel.
- It provides ECG serial ports and synchronous processing of data.
- It provides the switching control function related to the probe management.

4.1.4 Back-end Platform

- It provides the functions for the computing and central control.
- It provides the internal storage.
- It provides IO for other users: audio/video/USB/serial port/wired network/wireless network.

  USB: four USB 3.0 ports.

  HDMI: provides one HDMI port; the resolution which HDMI outputs supports four types of modes: 1024*768/1280*720/1280*1024/1920*1080; the resolution is decided by the user; full screen and standard screen are available the information that HDMI outputs.

  It provides two ports to two speakers (right/left channel).

  Wired Ethernet connection (port) provides one 1000 M port.

  Wireless Ethernet connection (port): one wireless network port embedded in the equipment, mPCIe port used in the wireless LAN adapter, internal antenna.

  ECG serial port provides ECG serial port to connect external ECG module;

4.1.5 Person-and-machine Communication

- It provides LCD display output;

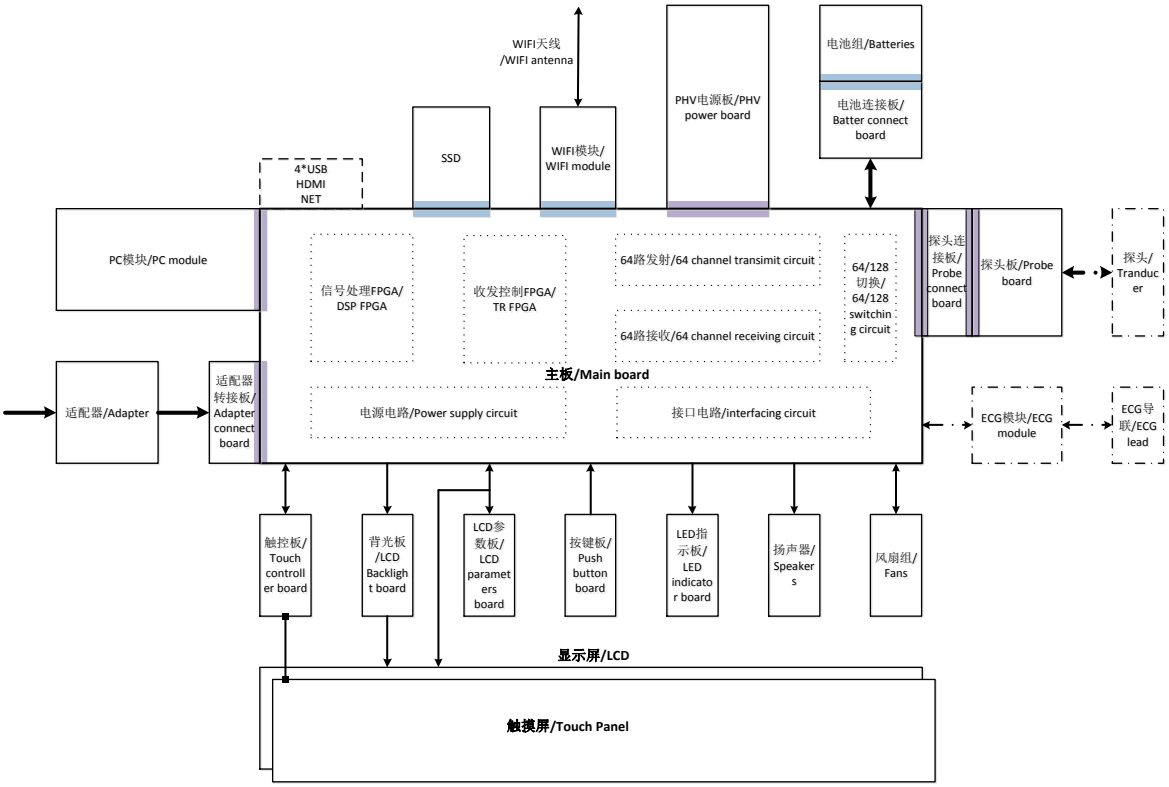
- Anti-glare
- Adjustable brightness
- It supports the calibration for color temperature and gamma.
- It shows the status of the entire system: battery discharging/charging status (orange)/standby status (orange)/AC available (green).
- It provides on/off button.
- It provides a touchscreen input.
- It provides multi-touch.
- It supports the wake-on-touch.

4.1.6 Power Supply & Battery

- It supplies the power for internal circuit and electronics.
- External 19 V adapter
- The battery supplies the power for the internal.
- The standby of the battery is longer than 24 hours.
- The maximum endurance time is longer than 2 hours.

4.2 Physical Structure of Hardware System

4.2.1 Physical Structure and Connection of Hardware System

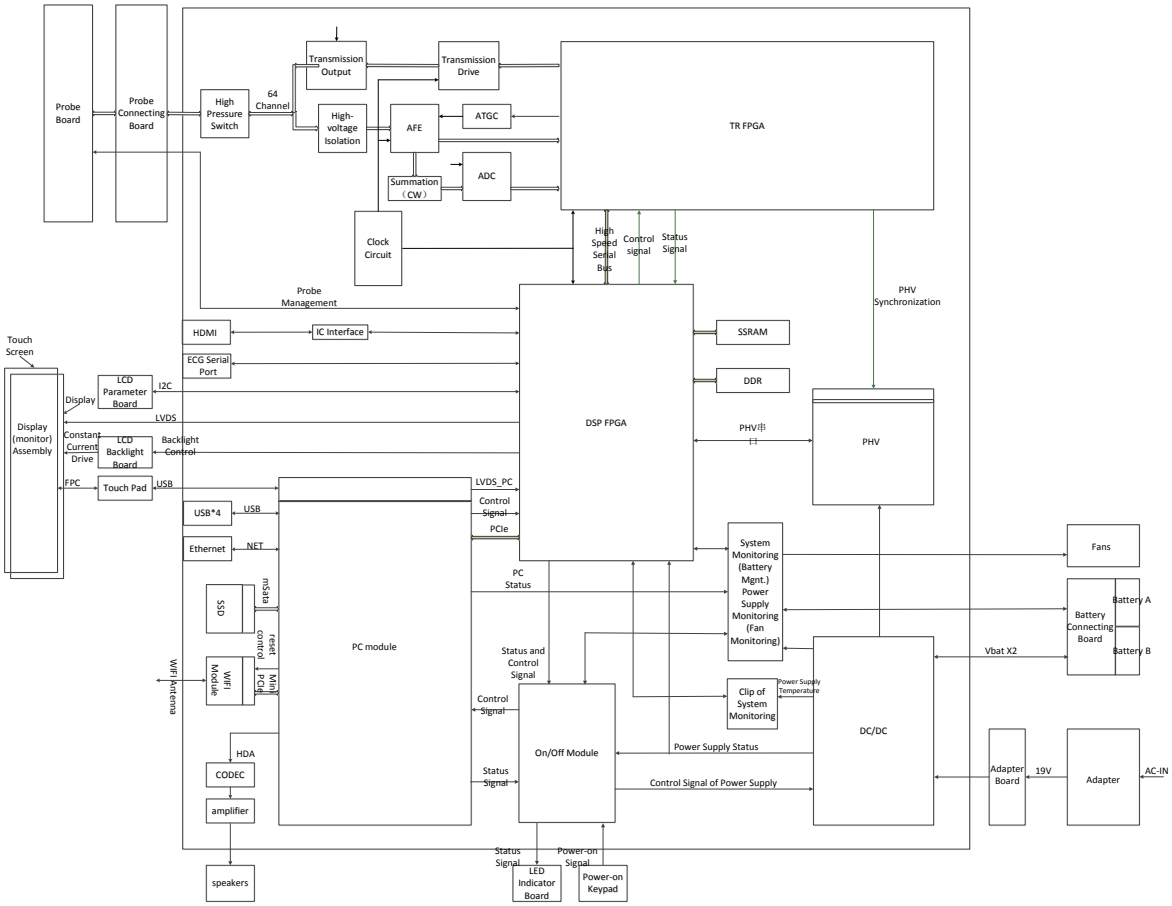


Picture 2 Connection Diagram of Hardware System

- Probe board, probe connection board and main board are connected via the sockets.
- The display is connected to the main board via the cables, including LVDS and parameter board.
- The display is connected to the backlight board via cables; the backlight board is connected to the main board via cables.
- Touchscreen panel is connected to the main board via cables; touchscreen is connected to the Touchscreen panel via FPC.
- Push button board is connected to the main board via cables.
- LED indicator board is connected to the main board via cables.
- The battery is connected to the battery board via the sockets; the battery board is connected to the main board via cables.
- The adapter is connected to the adapter board via cables; the adapter board is connected to the main board via the socket.

- Back-end fans are connected to the main board via cables; the cables of five pieces of fans come into one group of cables.
- The front-end fan is connected to the main board via cables.
- The speaker is connected to the main board via the cables. The cables of two speakers come into one group of cables.
- PHV board is connected to the main board via the socket.
- COME board is connected to the main board via the socket.
- SSD is connected to the main board via the socket.
- WiFi board is connected to the main board via the socket; the antenna is connected to the WiFi board via the socket.
- The main board provides one ECG serial port, one HDMI port, four USB 3.0 port and one Ethernet port.

4.2.2 Circuit Principle of Hardware System



Picture 3 The Diagram of Hardware Principle

4.2.3 Hardware Board

4.2.3.1 Probe Board

- The probe extension and probe connectivity are achieved on this board.
- It includes the single-probe port board and three-probe port board, and it can be configured before and after leaving the factory.
- The port on the probe board extends to three.
- The signal switching & probe connectivity are achieved on single-port probe board.
- The probe and the port on the main unit take form of the comprehensive probe port.

4.2.3.2 Probe Connecting Board

The probe connecting board transfers the signal; no circuit.

4.2.3.3 Main Board

Being the core of entire main unit, the main board fulfills most functions of the hardware.

- It provides switching function of 64/128 channel.
- It provides 64-channel transmitting circuit.
- It provides 64-channel receiving circuit.
- It provides clock circuit.
- It provides all functions of ultrasonic engine.
- It provides power supply circuits except for PHV/HV.
- It provides power supply and the port for the main console.
- It provides the port for the memory (SSD).
- It provides system monitoring.
- It provides power supply management.
- It provides physical port for User IO.
- It provides power supply and video sources for the display.
- It provides USB port and power supply for the touchscreen.
- It provides the adapter and the power supply port.

4.2.3.4 PHV Board

- It provides transmitting power supply for transmitting circuit on non-CW mode.
- It provides power supply for high-voltage switch (switching circuit of 64/128 channel).
- It provides PHV control circuit and control port.

4.2.3.5 COME Module

It provides functions of main console;

- Use PC module as the main console based on intel Core i7-3517UE processer.
- The port of PC module meets the requirement of COME 2.0 Type6 Pin-out.
- 2 GB memory, DDR 3, maximum capacity 16 GB.
- The highest 1.7 GHz basic frequency
- 7 PCIe x1
- 8*USB2.0,4*USB3.0
- It supports single-channel/dual-channel 18/24bit LVDS.
- 3 DDI, it supports HDMI/DVI/DisplayPort
- It supports 10/100/1000 Mbps Ethernet.
- It supports ATX power supply

4.2.3.6 Adapter Board

It transfers the power supply signal.
It provides EMI filter for the adapter input.

4.2.3.7 Battery Connecting Board

It transfers the battery signal.

4.2.3.8 LED Indicator

It transfers the status signal of the unit to the display of LED.

4.2.3.9 Keyboard

It provides the starting up button.

4.2.3.10 LCD Backlight Board

It provides constant current of backlight LED inside LCD display.

4.2.3.11 Touch Screen Control Board

It verifies the touching movements of the user and reports them to the main control platform.
It communicates with main console via USB port.

4.2.4 Hardware Module

4.2.4.1 Display (Monitor) Assembly

The assembly includes the touchscreen and the display, both of which are adhesive with optical bonding. It receives the input from the user and provides the output.

- Display: 15-inch, IPS, LED backlight, wide visual angle, 1024*768 resolution, anti-glare, LVDS port. 12 V power supply of display backlight; 3.3 V power supply of control circuit;

- Touchscreen: Projected capacitive, multi-touch, high-sensitivity design, available on-glove operation, anti-glare, connection to the touchscreen via FPC. 5 v power supply of touchscreen.

4.2.4.2 SSD

Memory space for the user and the system, 120GB SSD (initial release capacity), mPCIe port.

4.2.4.3 WIFI

It provides WiFi connectivity for the user.mPCIe port, 2.5GB/5GB dual-band, 802.1.b/g/n, internal antenna.

4.2.4.4 ECG Module

It provides the signal magnification, the filter and the sampling function for the main unit. External module. It connects to the main unit via serial port and uses ASIC chip from Mindray's monitoring department.

4.2.4.5 Adapter

It transfers the alternative current to the direct current. It provides direct current for the main unit. External module, 17.9 V, max. 167 V, full range input.

4.2.4.6 Battery

It provides the power supply for the main unit. It supports the running of the device without the adapter.Dual-battery, single battery capacity 14.8V/5800mAh, high-powered lithium battery, 4 concatenation, 2 parallel connection.

4.2.4.7 Fan

The fan is used to cool off the main unit with its whirling. 2 pieces in total: a group of 5 pieces of fans located at the bottom, 12V power supply, Adjustable voltage; an independent fan located on the front top of the radiator, 5V power supply, Adjustable voltage.

4.2.4.8 Radiator

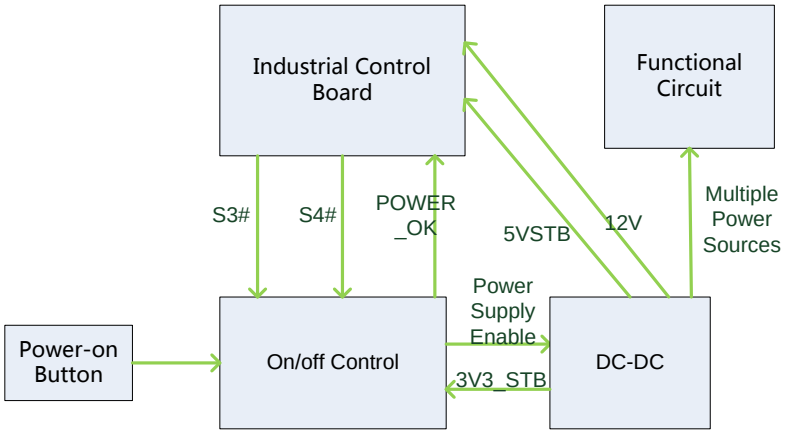
There are two radiators inside the mian unit: the radiator of COME module and front top radiator. Both of them cool off the COME module and the front circuit on the main board.

4.2.4.9 Speaker

It provides the electric-acoustic for the main unit, and then comes into the acoustic output.Left/right speaker, improved loudspeaker box design.

4.2.5 The Description on Hardware System

4.2.5.1 System Power-on Control



Picture **4 System Power-on Control**

- The description of related controlling signals:

No.	Controlling signal	Description
1	PWR_BTN_N,PWR_BTN#	Pulse signal that power-on button of control panel produces passes to CPU board through FPGA, and is used for starting the device.
2	S3#	CPU board output effectively represents that CPU system is in the standby status and keeps 5VSTB powered on when it is in standby via FPGA.
3	S4#	Output by CPU board, effectively represents that CPU system is in dormancy.
4	S5#	The signal is not used currently
5	PWR_OK#	Sent out by power management FPGA to CPU board, indicates that the 12V is powered on.

- Power supply of main unit/battery enables the start of device.
- Power supply produces 5VSTB and 3.3VSTB as the AC connects.
- Unplug AC when shutting down the device. Power supply cuts off 5VSTB output, but only keeps the output of 3.3VSTB. Only with power button pressed again, it's re-powered on.
- Unplug AC when the device is in standby. Batteries, for standby usage, provide the output of 5VSBT and 3.3VSTB.
- The process of power-on is shown below:

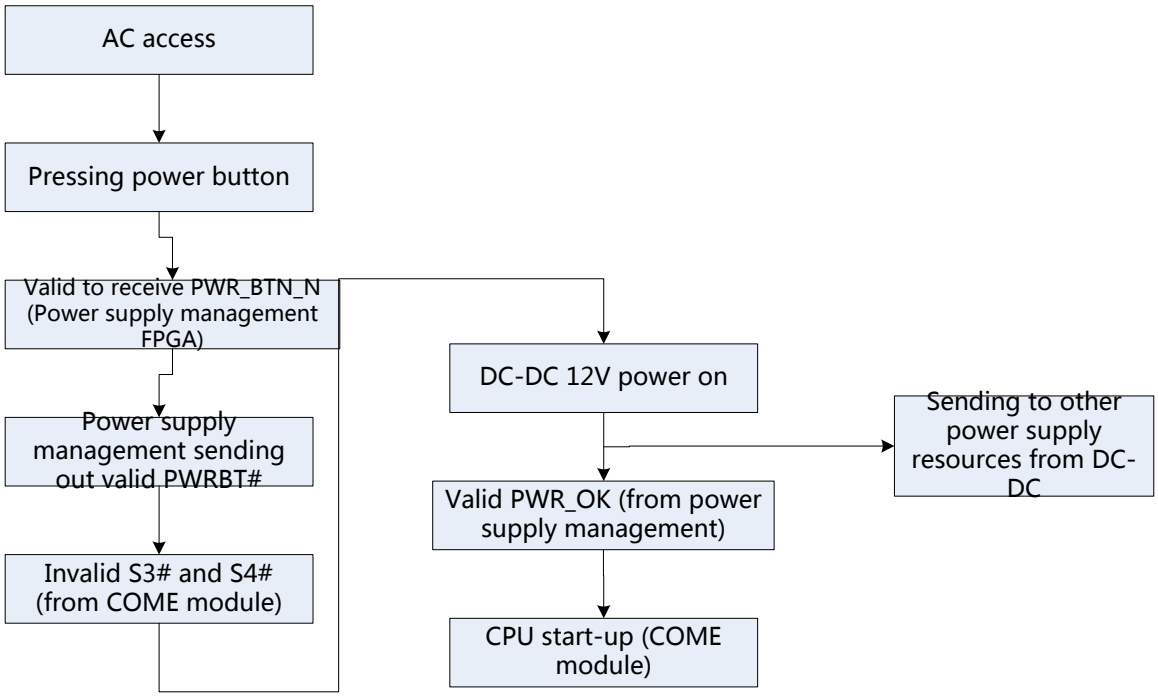
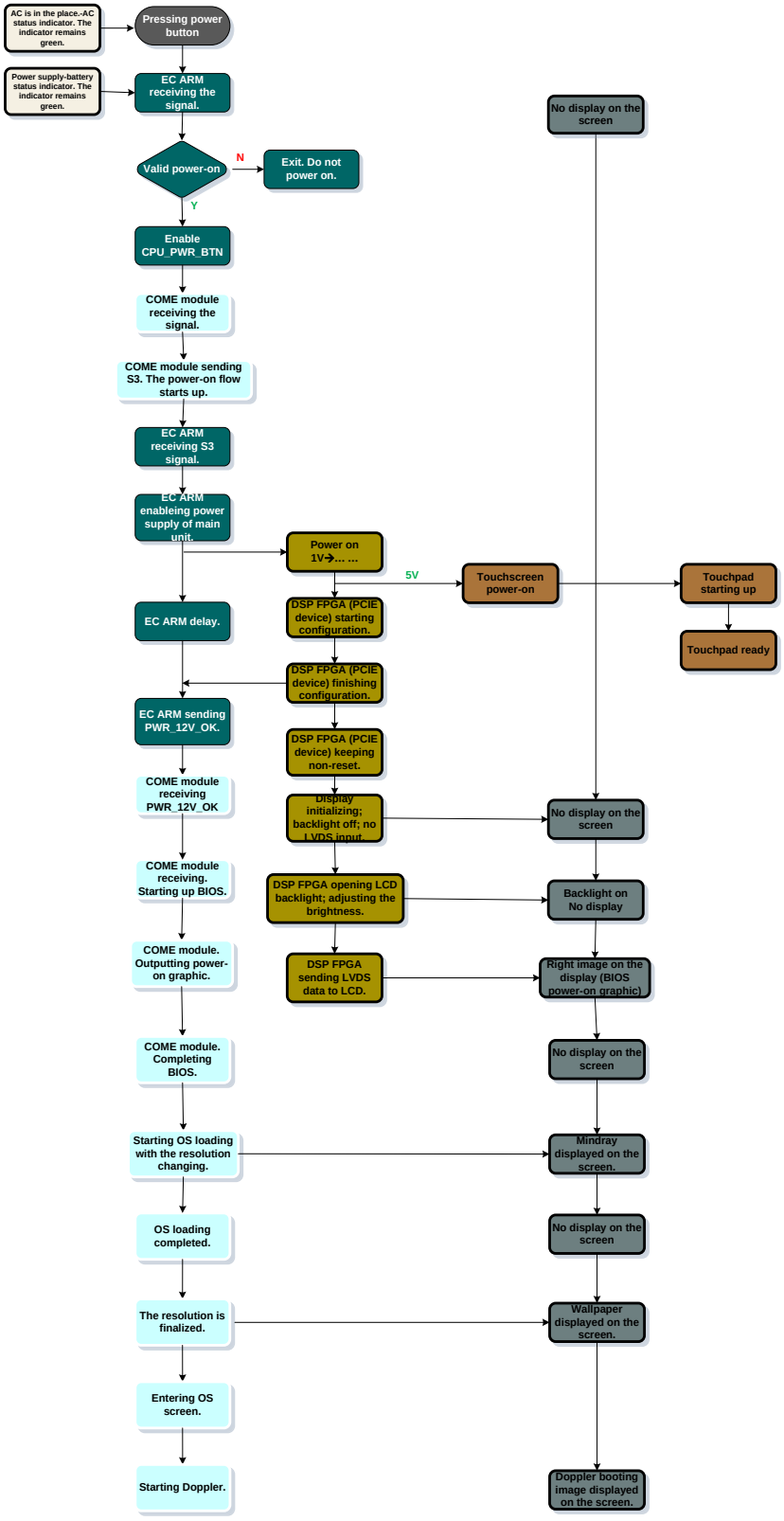

AC access
Pressing power button
Valid to receive PWR_BTN_N (Power supply management FPGA)
Power supply management sending out valid PWRBT#
Invalid S3# and S4# (from COME module)
DC-DC 12V power on
Sending to other power supply resources from DC-DC
Valid PWR_OK (from power supply management)
CPU start-up (COME module)

图 5 System power-on diagram

4.2.5.2 Details on Main Unit's Power-on

Start-up procedure of main unit and the performance of power supply & display in various steps are shown below:


AC is in the place.-AC status indicator. The indicator remains green.
Pressing power button
Power supply-battery status indicator. The indicator remains green.
EC ARM receiving the signal.
Valid power-on
N
Exit. Do not power on.
Y
Enable CPU_PWR_BTN
COME module receiving the signal.
COME module sending S3. The power-on flow starts up.
EC ARM receiving S3 signal.
EC ARM enableing power supply of main unit.
Power on 1V→... ...
5V
Touchscreen power-on
Touchpad starting up
Touchpad ready
EC ARM delay.
DSP FPGA (PCIE device) starting configuration.
DSP FPGA (PCIE device) finishing configuration.
EC ARM sending PWR_12V_OK.
DSP FPGA (PCIE device) keeping non-reset.
COME module receiving PWR_12V_OK
Display initializing; backlight off; no LVDS input.
No display on the screen
COME module receiving. Starting up BIOS.
DSP FPGA opening LCD backlight; adjusting the brightness.
Backlight on No display
COME module. Outputting power-on graphic.
DSP FPGA sending LVDS data to LCD.
Right image on the display (BIOS power-on graphic)
COME module. Completing BIOS.
No display on the screen
Starting OS loading with the resolution changing.
Mindray displayed on the screen.
OS loading completed.
No display on the screen
The resolution is finalized.
Wallpaper displayed on the screen.
Entering OS screen.
Starting Doppler.
Doppler booting image displayed on the screen.

5 Checking Performance and Functions

5.1 Description

The chapter describes checking methods to main functions and performance. The methods are only for reference.

5.2 Checking System Status

5.2.1 Running Status

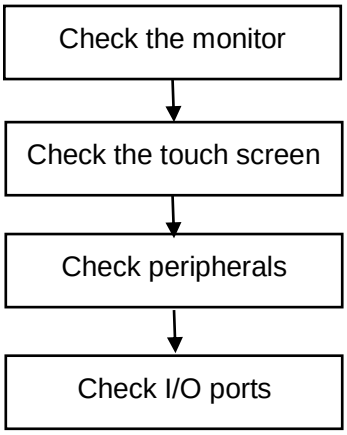
1. Power on/off normal (duration time is normal), no abnormal sounds or occasion occur during normal operation.
2. After ultrasound system gets started, the fan starts working, and no abnormal noise is heard when the fan is working.
3. Check whether product configurations and software versions are normal via [About] interface.
4. Check whether contrast and brightness of the monitor are normal.
5. Check whether time and date are valid and correct.
6. Check whether all status indicators are normal.
7. Check all log records together with the users to confirm whether there are any abnormalities.

5.2.2 Working Condition

Check the ambient temperature and humidity. The measurement related to security features is sensitive to humidity. If the insulation feature of the system deteriorates due to the increase of system service time or system malfunctions, the fluctuation range of measurement results are likely to increase with the humidity increasing.

5.3 General Check

5.3.1 Check Flow



5.3.2 Check Content

5.3.2.1 Check Monitor

Procedure	Checking criteria
● Monitor brightness adjustment ● Monitor contrast adjustment ● Monitor maintenance Log on with the account named as “Service”. Tap in the top-right corner of the screen and select to enter the setup menu, and click [Maintenance] - [Setup] - [Test Main Monitor] to check the monitor functions.	◆ Height adjustment: Tap in the top-right corner of the screen and drag the adjusting point to change the brightness on the brightness control . ● Tap in the top-right corner of the screen and drag the adjusting point to change the contrast on the brightness contrast . ● The monitor display works well after testing each function. Bad points are: 1 Light dot is 0; blinking dot defect is 0. 2 The adjoining dark dots are no more than 3 pairs, and there are no adjoining dark dots in image area. 3. 3 or 3 successive dark dots are no more than 0 pair. The dark dots are no more than 7 and those in the image area are no more than 2

	5 The distance between bad dots is no less than 5mm. Note: the image area refers to the area enclosed by the rectangle with black/white background.

5.3.2.2 Check Touch Screen

Procedure	Standard
Check if keys on the touch screen of B/ M/CW/Color basic modes can respond normally.	All keys function are effective.

5.3.2.3 Checking Peripherals

Procedure	Checking criteria
Footswitch: confirm the normal connection between footswitch and USB port. Check the configuration status of footswitch under [Key Config] and corresponding implementation. (E.g. right key-image freeze; middle key-color print; left key-white/black print).	Trigger the freeze key of the footswitch (right key). Image freeze menu and freeze menu appear. The image is unfrozen if the key is triggered again. Trigger the print key of the footswitch (middle key). Start color print. Trigger the print key of the footswitch (left key). Start black/white print.
Digital Video printer: confirm the connection between video printer and ultrasound device works well and check the implementation of each function.	Press the Print key which is setup well already to start the print. The image has no defect or degradation. Switch USB port, and then repeat the previous steps.
Graph/text printer: confirm the connection between graph/text printer and ultrasound device works well and check the implementation of each function.	Press the Print key which is setup well already to start the print. The image has no defect or degradation.
Barcode reader: scan any piece of barcode when the system is under running.	The barcode information displays on the image interface. The information is correct compared with the data information of barcode.
DVD-R/W ● Press [Eject] ● Use the optical disk drive to read and burning.	● Disk can be normally ejected. ● Normal, no abnormal sounds.
ECG ● Connects ECG lead. ● Click [Physio] to enter its interface.	● ECG activation, ECG waveform and heart icon appear on the right corner of the interface. ● The parameters for [Scan speed], [ECG gain] and [ECG position] can be adjusted in real-time. ● Review ECG signals.

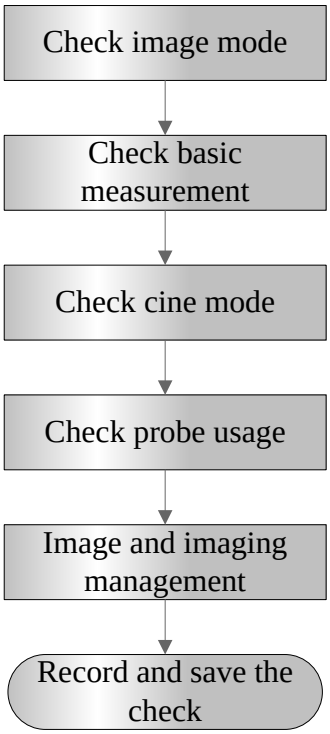
5.3.2.4 Checking I/O Interface

Procedure	Checking criteria
Checking I/O interface: ● Verify USB port ● Network port ● HDMI port	● Network connection and communication work well. ● USB storage and read work well. ● HDMI connection and communication work well.

5.4 Functions Checking

Note: The chapter lists the system checking items with complete configurations and describes them in details. If the items are not configured, the relevant tests can be ignored.

5.4.1 Checking Flow



5.4.2 Checking Content

5.4.2.1 Imaging Mode

■ B-mode

1. Enter the patient information. Select an appropriate probe and exam mode.
2. Tap [B] on the right side of the operating panel to enter B mode.
3. Tap [Image] to open the image menu. Adjust the parameters to optimize the image.

- In B mode scan, the image parameter area in the upper left corner of the screen displays the real-time parameter values as follows:

Items	F	D	G	FR	DR
Meaning	Frequency	Depth	Gain	Frame Rate	B Dynamic Range

- Parameters that can be adjusted to optimize the B Mode image are indicated in the following.

Adjustment	Parameter Item
Tap [B]-[Image] on the right side of the operating panel to enter B mode.	Frequency (image quality), Gain, Depth, TGC, Acoustic Power, Focus, Image Adjustment, Rotation/Invert, iBeam, Gray Map, iTouch, H Scale, Line Density, Dynamic Range, iClear, Persistence, TSI, Echo Boost, Patient Temperature

Parameter Adjustment

Procedure	Checking criteria
Tap <B>-[Image] on the right side of the operating panel.	Enter B mode image. B mode interface appears.
Frequency adjustment Select the different frequency values through at left part of the image area.	The real-time value of frequency is displayed in the image parameter area in the upper right corner of the screen (fundamental wave-F, Harmonic frequency-H). Values of frequency vary depending upon the probe types.
Gain adjustment G Drag the [Gain] control on the right part of the image area to adjust the gain.	Scroll up to increase the gain, and scroll down to decrease the gain.
Depth adjustment D Drag the [Depth] control on the right part of the image area to adjust the depth.	Scroll up to increase the depth, and scroll down to decrease the depth.
TGC adjustment Tap in the bottol-left corner of the image area to open the TGC adjusting dialogue box	To increase the gain compensation in an area of interest, drag the TGC control to the right. To decrease the gain compensation in the corresponding area of interest, drag the control to the left. Double-click any area on the dialogue box, all 6 TGC controls will return to middle state. About 1.5 seconds after the adjustment is complete, the TGC curve disappears.
Acoustic power adjustment Adjust through [A.Power(%)] on the menu. Tap [-] or [+] to change the value slightly or drag the control directly.	The adjusting range is 3.2-96.6. The real-time value of which is displayed in the top-left part of the screen.

Focus ● Adjust the focus number through [Focus Number]. Tap [-] or [+] to change the value slightly or drag the control directly. ● Drag ◀ on the right part of the image area to change the focus position.	Focus position/number adjustment The focus position icon ◀ is displayed on the right side of the image.
FOV (Field of View) Adjust through [FOV Size (%)] on the menu. Tap [-] or [+] to change the value slightly or drag the control directly.	You can get a much larger field of view when selecting a larger FOV. The frame rate decreases when using a larger FOV.
Steer Steer the probe by tapping buttons on the bottom of the image area. 	To steer the beam the probe transmits.
ExFov Adjust through [ExFOV] on the menu.	For linear probes, the ExFOV function displays as trapezoid imaging. For convex probes, the ExFOV function displays as extending the scanning angle.
Line Density Adjust through [Line Density] on the menu.	The function determines the quality and information of the image. Levels of line density: UH/ H/ M/ L.
Dynamic Range Adjust through [Dyn Ra.] on the menu.	Tap [-] or [+] to change the value slightly or drag the control directly. The adjusting range is 30-240, in increments of 5.
iClear Adjust through [iClear] on the menu.	Tap [-] or [+] to change the level slightly or drag the control directly. The system provides 7 levels of iClear adjustment: off represents no iClear effect, and the bigger the value the stronger the effect.
Persistence Adjust through [Persistence] on the menu.	Tap [-] or [+] to change the level slightly or drag the control directly. The system provides 7 levels of frame average adjustment: the bigger the value the stronger the effect.
Rotation/Invert Rotate the image using the [Rotation] control.	To invert the image horizontally or vertically. Image can be rotated by the angle of 0°, 90°, 180° and 270°. When the image is rotated in the angle of 90° or 270°, the depth scale is displayed on the upper part of the screen. The “M” mark indicates the direction of the image; the M mark is located on the top of the imaging area by default.

iBeam Adjust through [iBeam] on the menu.	The system provides different levels of iBeam effect. Off represents no iBeam.
Gray Map Select maps by using [Gray Map] control.	Tap [-] or [+] to select. The system provides 8 different gray effect maps.
Tint Map Select maps or turn on/off the function by using [Tint Map] control.	Tap [-] or [+] to select. The system provides 8 different color effect maps.
TSI Select different TSI modes using the [TSI] control.	The system provided 4 ways of optimization for specific tissues: general, muscle, fluid and fat.
iTouch Tap on the left part of the image area to start iTouch.	Tap on the left part of the image area to start iTouch. Long press to exit. Adjust iTouch gain value through [iTouch] on the image menu.
H Scale Select [H Scale] control to display or hide the scale.	They change together in zoom mode, or when the number of the image window changes. When the image is turned up/down, the H Scale will also be inverted.
Echo Boost Set [Echo Boost] “On” to turn the function on.	Set [Echo Boost] “On” to turn the function on (when the function is turned on, the system indicates “Echo Boost” in the image parameter area).
Patient Temperature Enter the temperature by tapping [Patient Temperature].	If the current active probe is P7-3Ts, the parameter will display under the B mode menu. Enter the temperature by tapping [Patient Temperature].

- M mode
  1. Select a high-quality image during B mode scanning, and adjust to position the area of interest in the center of the B mode image.
  2. Tap [M] on the right side of the operating panel to enter M sampling line status, and drag the sampling line to the desired position.
  3. Tap [M] again or tap [Update] (at the bottom-left part of the operating panel) to enter M mode. You can then observe the tissue motion along with the anatomical images of B mode. During the scanning process, you can also adjust the sampling line accordingly when necessary.
  4. Adjust the image parameters to obtain optimized images.

◆ In M mode scanning, the image parameter area in the top-left corner of the screen displays the real-time parameter values as follows:

Parameter	F	D	G	V	DR
Meaning	Frequency	Depth	M Gain	M Speed	M Dynamic Range

During M mode imaging, menus for B mode and M mode are displayed on the operating panel at the same time. You can switch between the 2 modes by tapping the mode tab.

During M mode scanning, depth, focus position, frequency and acoustic power of the probe are synchronous with that of B mode.

Adjustment of the TGC to the B mode image will lead to synchronous changes in the M mode image.

◆ Parameters that can be adjusted to optimize the M Mode image are indicated in the following.

Adjustment	Parameter Item
Tap [M]-[Image] on the operating panel to enter M mode.	Gain, Display Format, Speed, Tint Map, Gray Map, Edge Enhance, Dynamic Range, M Soften

Parameter Adjustment

Procedure	Checking criteria
Tap <M>-[Image] on the right side of the operating panel.	Enter M mode image. M mode interface appears.
Gain Drag the [Gain] control on the right part of the image area to adjust the gain.	Scroll up to increase the gain, and scroll down to decrease the gain.
Display Format Select different layout through [Display Format].	There are 4 formats available for image display: V2:3, V3:2, V3:1, Full.
Speed Adjust through [Speed (mm/s)] on the menu.	There are 6 levels of scan speed available.
Tint Map Select maps or turn on/off the function by using [Tint Map] control.	Tap [-] or [+] to select. The system provides 8 different color effect maps.
Gray Map Select maps by using [Gray Map] control.	Tap [-] or [+] to select. The system provides 8 different gray effect maps.
Edge Enhance Adjust through [Edge Enhance] on the menu.	There are 3 levels of edge enhance adjustment available: the bigger the value the stronger the effect. 0 represents no edge enhance effect.
Dynamic Range Adjust through [Dyn Ra.] on the menu.	Tap [-] or [+] to change the value slightly or drag the control directly. The adjusting range is 30-180, in increments of 5.
M Soften Adjust through [M Soften] on the menu.	The system provides 4 levels of M Soften adjustment: the bigger the value the stronger the effect.

■ Color mode

1. Select a high-quality image during B mode scanning, and adjust to position the area of interest in the center of the B mode image.
2. Tap [Color] on the right side of the operating panel to enter Color mode.
3. Change the position and size of the Region of Interest (ROI).
4. Adjust the image parameters during scanning to obtain optimized images.

◆ In Color mode scan, the image parameter area on the right side of the screen displays the real-time parameter values as follows:

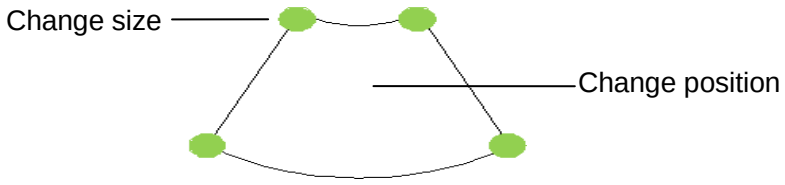
Parameter	F	G	PRF	WF
Meaning	Frequency	Color Gain	Pulse Repetition Frequency (PRF)	Color Wall Filter

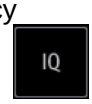
In Color mode, the acoustic power is synchronous with that of B mode. Adjustment of the depth to the B mode image will lead to corresponding changes in Color mode image.

◆ Parameters that can be adjusted to optimize the Color mode image are indicated in the following.

Adjustment	Parameter Item
Tap [Color]-[Image] on the operating panel to enter Color mode.	Color Gain, ROI Adjustment, Frequency (Image Quality), B/C Align, Steer, Line Density, Packet Size, Flow State, Persistence, Smooth, Scale, Baseline, Invert, Color Map, WF (Wall Filter), Priority, iTouch, Smart tracking

Parameter Adjustment

Procedure	Checking criteria
Tap <Color>-[Image] on the right side of the operating panel.	Enter Color mode image. Color mode interface appears.
Color Gain Drag the [Gain] control on the right part of the image area to adjust the gain	Scroll up to increase the gain, and scroll down to decrease the gain.
ROI Adjustment Tap the corner (green dot) of the ROI and drag to change the size	Tap inside the ROI box and drag to change the position. 

Frequency (Image Quality) Select the different frequency values through  at left part of the image area	The adjusting range of frequency values can be divided into 3 levels: penetration preferred (Pen), general mode (Gen), and resolution preferred (Res).
B/C Align Turn the function on or off using the [B/C Align] control	The frame rate increases when the function is turned on
Steer Steer the probe by tapping buttons on the bottom of the image area. 	This function is used to adjust the scan angle of linear probes, so as to change the angle between the transmitting beam and flow direction
Line Density Adjust through [Line Density] on the menu.	There are four levels of line density available: UH, M, H, L. The higher the line density, the higher the resolution.
Packet Size Select different effects through [Packet Size]	There are 3 levels of packet size available: 0 represents no packet size control and the bigger the value the higher the sensitivity. The higher the packet size, the more sensitive the indication for low-velocity flow.
Flow State Select different effects through [Flow State]	3 levels are provided: L, M, H.
Persistence Select different effects through [Persistence]	The system provides 6 levels of persistence adjustment: 0 represents no persistence, and the bigger the value the stronger the effect
Smooth Adjust through [Smooth] on the menu	The system provides 6 levels of smooth function: the bigger the value the stronger the effect.
Scale Use [Scale] to adjust PRF values	Tap [-] or [+] to change the value slightly or drag the control directly. The adjusting range varies according to the frequency, probe and depth. Adjust according to the actual situation.
Baseline Adjust through [Baseline] on the menu	A positive value means increase the signals above the baseline, and a negative value means increase the signals below the baseline
Invert Turn the function on or off using the [Invert] control	Select “Auto Invert” in [Setup] → [System] → [Image], so the color bar can automatically invert when the color flow is steered to a certain angle to accommodate the operator’s desire to distinguish the flow direction.

Color Map Select maps by using [Color Map] control	The system provides 21 different maps for selection. The V group provides 11 ordinary maps and the VV group provides 10 2D maps.
WF (Wall Filter) Adjust through [WF] on the menu.	There are 8 levels of wall filter function available. Select the value according to the actual situation.
Priority Adjust through [Priority (%)] on the menu	Tap [-] or [+] to change the level slightly or drag the control directly. The adjusting range of the priority is 0-100% in increments of 1%.
iTouch (Auto Image Optimization) Tap on the left part of the image area to get iTouch optimization	To optimize image parameters as per the current tissue characteristics for a better image effect. Tap on the left part of the image area to get iTouch optimization.
Smart tracking (ROI auto position/steer in Color/PW mode) Turn on/off the function by [Smart Tracking] on the menu.	Under B+Color+PW mode, this feature also optimizes PW sampling line angle, SV size and position.

- Power mode
  1. Select a high-quality image during B mode or B + Color scanning, and adjust to position the area of interest in the center of the image.
  2. Tap [Power] on the right side of the operating panel to enter Power mode.
  3. Change the size and position of the ROI (the same as in Color mode).
  4. Adjust the image parameters during B + Power mode scanning to obtain optimized images.

◆ In Power mode scan, the image parameter area on the right side of the screen displays the real-time parameter values as follows:

Parameter	F	G	PRF	WF
Meaning	Frequency	Power Gain	Pulse Repetition Frequency (PRF)	Power Wall Filter

In Power mode, the acoustic power is synchronous with that of B mode. Adjustment of the depth to the B mode image will lead to corresponding changes in Power mode image.

Parameters consistent with those in Color mode and B mode are not described. See the relevant Color mode and B mode sections, while special items of the Power mode are introduced in the following.

◆ Parameters that can be adjusted to optimize the Power mode image are indicated in the following.

Adjustment	Parameter Item
Tap [Power]-[Image] on the operating panel to enter Power mode.	Power Gain, Power Map, Dynamic Range

Parameter Adjustment

Procedure	Checking criteria
Tap <Power> - [Image] on the right side of the operating panel.	Enter Power mode image. Power mode interface appears.
Power Gain Drag the [Gain] control on the right part of the image area to adjust the gain.	The real-time gain value is displayed in the image parameter area in the top-left corner of the screen. Scroll up to increase the gain, and scroll down to decrease the gain.
Power Map Select maps by using [Color Map] control	There are 8 kinds of maps provided: P0-3 belong to Power mode maps, while Dp0-3 belong to Directional Power mode maps.
Dynamic Range Adjust dynamic range through [Dyn Ra.]	Tap [-] or [+] to change the value slightly or drag the control directly. The adjusting range is 10-70 in increments of 5.

- PW / CW Mode
  a) Select a high-quality image during B mode or B + Color (Power) mode scanning, and adjust to position the area of interest in the center of the image.
  b) Tap [PW]/[CW] on the right side of the operating panel to enter PW/CW sampling line adjustment status.

     The sampling status will be displayed in the image parameter area in the top-left corner of the screen as follows:

a) PW Sampling Line Adjustment	b) SV
	c) Angle
	d) SVD
e) CW Sampling Line Adjustment	f) Angle
	g) CW Focus Depth

  c) Set the position of the sample line by dragging the sampling line; drag the SV gate to place the SV on the target.
  d) Adjust the angle and SV size according to the actual situation: drag the PW angle line to change the angle, pinch on the image area to adjust SV size.
  e) Tap [PW]/[CW] again or tap [Update] (at the bottom-left part of the operating panel) to enter PW/CW mode and perform the examination. You can also adjust the SV size, angle and depth in real-time scanning.
  f) Adjust the image parameters during PW/CW mode scanning to obtain optimized images.

◆ In PW/ CW mode scan, the image parameter area on the right side of the screen displays the real-time parameter values as follows:

Parameter Item	F	G	WF	PRF	SVD	SV	Angle
Meaning	Frequency	Gain	Wall Filter	Pulse Repetition Frequency	SV Position	SV Size (Only for PW mode)	Angle

When you adjust the depth of the B mode image, related changes will occur in the PW/CW mode image as well.

Most of the parameters are the same for the PW mode and CW modes, so parameters of both are combined together to be introduced here.

Only phased probes support CW mode.

◆ Parameters that can be adjusted to optimize the PW/ CW mode image are indicated in the following.

Adjustment	Parameter Item
Tap [PW/CW]-[Image] on the operating panel to enter PW/CW mode.	Gain, SV, Depth, iTouch, Auto Calculation, Invert, Scan Speed, T/F Res, WF, Tint Map, Gray Map, Display Format, Duplex/Triplex, HPRF, Baseline, Angle, Quick Angle, Dynamic Range, Volume, Steer, Scale.

Parameter Adjustment

Procedure	Checking criteria
Tap <PW/CW> - [Image] on the right side of the operating panel.	Enter PW/CW mode image. PW/CW mode interface appears.
Gain Drag the [Gain] control on the right part of the image area to adjust the gain	The real-time gain value is displayed in the image parameter area in the top-left corner of the screen. Scroll up to increase the gain, and scroll down to decrease the gain.
SV ● Adjust SV size by finger gesture. ● Tap and drag the SV gate to change depth.	● Adjust SV size by finger gesture. Use two fingers to adjust the SV size by pinching movement on the image area. Value: 0.5-20 mm. ● Tap and drag the SV gate to change depth.
CW Focus Position Tap and drag the SV to select the focus depth	The real-time focus position value is displayed in the image parameter area in the top-left corner of the screen. Tap and drag the SV to select the focus depth.
Frequency (Image Quality) Select the different frequency values through at left part of the image area	The adjusting range of frequency values can be divided into 3 levels: penetration preferred (Pen), general mode (Gen), and resolution preferred (Res). Select the frequency according to the detection depth and current tissue features.

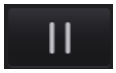
Scale Use buttons on the right part of the image area to adjust PRF values. 	Provides a much clearer color flow image. Use a low PRF to observe low-velocity flows, and a high PRF to observe high-velocity flows.
ITouch Tap on the left part of the image area to get iTouch optimization	To optimize image parameters as per the current tissue characteristics for a better image effect. Tap on the left part of the image area to get iTouch optimization.
Auto-Calculation 1. Tap [Auto Calc] to turn the auto calculation function on or off. 2. After auto calculation function is turned on, select “Auto Calc” tab to enter the auto calculation menu. Click [Auto Calc Param.] to select parameters: [Auto Calc Cycle] [Trace Area] [Trace Smooth] [Trace Sensitivity]	● Adjust through [Auto Calc Cycle] on the menu. ● Adjust through [Trace Area] on the menu. The available selections of trace area are: Above, Below, All. ● Adjust through [Trace Smooth] on the menu. There are 4 levels of smooth effect provided, the bigger the value, the higher the smooth processing. ● Adjust through [Trace Sensitivity] on the menu. There are 5 levels of sensitivity adjustment, the bigger the value the higher the sensitivity. In real-time scanning, the results displayed are derived from the calculation of the latest cardiac cycle. In the freeze and cine status, the results displayed are calculated from the current selected area.
Invert Turn the function on or off using the [Invert] control	Select “Auto Invert” in the [Setup] -> [System] -> [Image], so the spectrum can automatically invert when the color flow is steered to a certain angle to accommodate the operator’s desire to distinguish the flow direction
Speed Adjust through [Speed (mm/s)] on the menu	There are 6 levels of scan speed available. Changing the speed makes it easier to identify the cardiac cycles and to detect more details.
T/F Res. Adjust through [T/F Res.] on the menu	There are 4 levels of T/F Res. values available
Wall Filter Adjust through [WF] on the menu	7 levels of wall filter function are provided.
Tint Map Select maps or turn on/off the function by using [Tint Map] control	Tap [-] or [+] to select. There are 8 color effect maps available.

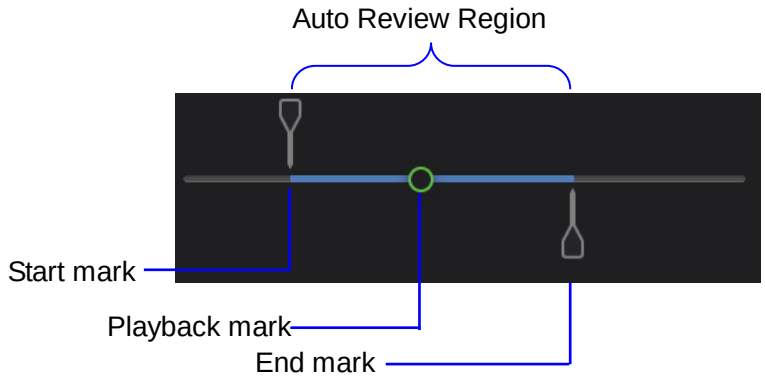
Gray Map Select maps by using [Gray Map] control	Tap [-] or [+] to select. There are 10 gray effect maps available.
Display Format Select different layout through [Display Format]	There are 4 formats for displaying the images: V2:3, V3:2, V3:1, Full.
Duplex/Triplex Select [Duplex]/[Triplex] to turn the synchronization on or off.	Select [Duplex]/[Triplex] to turn the synchronization on or off. This function is used to set whether a B image (B + Color image) and PW image are displayed synchronously.
HPRF Turn the function on or off using the [HPRF] control	Turn the function on or off using the [HPRF] control
Baseline Tap and drag the green baseline on the spectrum to change the position	Tap and drag the green baseline on the spectrum to change the position. Changes the flow-velocity range to optimize the image.
Angle Adjust through [Angle] on the menu	Tap [-] or [+] to change the value slightly or drag the control directly. The adjustable angle range is -89~89°, in increments of 1°.
Quick Angle Tap the three buttons above [Quick Angle] on the bottom of the image area	Tap the three buttons above [Quick Angle] on the bottom of the image area. There are 3 angles for quick adjustment: -60°, 0° and 60°.
Dynamic Range Adjust dynamic range through [Dyn Ra.]	Adjust dynamic range through [Dyn Ra.]. Tap [-] or [+] to change the value slightly or drag the control directly. The adjusting range is 24-72. The more the dynamic range, the more specific the information and the lower the contrast with more noise.
PW Volume Adjust through [Volume] on the menu	Adjust through [Volume] on the menu. Tap [-] or [+] to change the value slightly or drag the control directly. The adjusting range of the audio is 0-100%. Utilizing the output audio helps to identify the feature and the status of flow.
PW Steer Steer the probe by tapping buttons on the bottom of the image area. 	This feature is used to steer the direction of the beam so as to change the angle between the beam and flow direction with immobility of the linear probe. The PW Steer function is available only for linear probes.

5.4.2.2 Basic Measurement

Procedure	Checking criteria
B mode: ● Tap [Measure] -> [Basic] on the operating panel of the touch screen ● Tap [Measure] -> [Advanced] on the operating panel of the touch screen	● Enter basic measurement mode ● Enter advanced measurement mode Measure 1-2 items (such as length, area). The system displays and updates measurement results in the results window.
Tap [Measure].	Exit the corresponding measurement.
Similar operations for other modes	Application measurement options agree with various application software packages.

5.4.2.3 Cine Review

Procedure	Checking criteria
● Enter "[Setup] -> [System] -> [Image] -> "Freeze Config." to set "Status after Freeze" to "Cine." The system enters manual cine review status once [Freeze] is touched to freeze the image. ● Open cine files in Review. The system enters automatic cine review status.	● Enter Cine Review status ● The system enters auto review status.
drag playback mark to review the cine images on the screen one by one	Manual cine review
In manual cine review status, tap to activate auto cine review.	Start auto review. Reviewing speed: in auto cine review status, tap to select different speeds: 1/10x, 1/5x, 1/4x, 1/2x, 1x. In auto play status, tap  to stop auto play.
Drag to the frame which you want to set it as start point.	Set start point of auto review.
Drag to the frame which you want to set it as end point.	Set end point of auto review.
Tap to start play and select the speed.	The cine review plays between the start point and the end point.
Tap [UnFreeze] to defreeze the image again.	Return to scan status with the image defreezing and exit cine review.



5.4.2.4 Probe Switch and Recognition

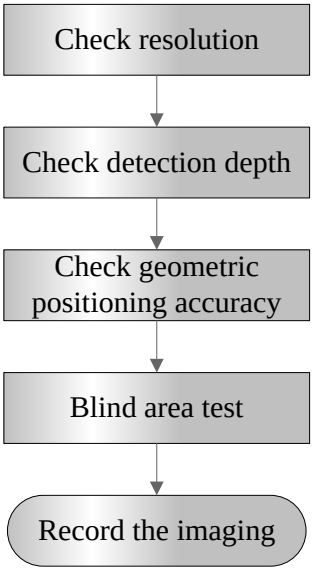
Procedure	Checking criteria
Tap [Freeze] – plug the probe – tap [Freeze] – tap [Probe].	Ultrasound device can be recognized while connecting the probe.
Tap [Freeze] – unplug the probe – plug a new probe.	Recognize the probe type instantly.

5.4.2.5 Image and Imaging Management

Procedure	Checking criteria
Tap [Save Image] in scan process	Save B mode image to patient data library in real-time.
Select [Preset]-[System Preset]-[General]. Select “Exam Setup” from “Scan/Register”. Tap <End Exam> in scan process.	The system enters the status after exam ends.
● Tap [Review] ● Tap [Cancel] on the review interface.	● To enter Review ● To exit Review
● Tap [Preset]-[iVision] to enter iVision interface. ● Add the demonstration item, and select display method. Select a demo from the list, and then tap [Start]. ● Tap [Exit] or tap <Esc> to exit after the demonstration finishes.	● Enter iVision screen ● Start image demonstration Image files are played according to file names one by one (including the image of system-relevant and PC-compatible format). ● Exit the image demonstration
Tap <iStation> to enter patient information management interface.	Agree with patient’s ID. View the real-time image/imaging information. The following operations are also available: ● Back up (Restore) ● Send (DICOM, USB flash disk, etc)

5.5 Performance Test

5.5.1 Test Procedures



5.5.2 Test Content

Note:	The following figure is only used for reference in the testing, and the actual image effect depends on the specific system.

◆ **Requirements:**

1. Display: set the brightness and contrast values to clinical (or default) status;
2. Ambient: dark room to simulate actual clinical using;
3. The probe surface should contract with the acoustic window without separation or pressing.

◆ **Description:**

Refer to <Appendix B Illustration or Phantom Using> for the phantoms used in the test.
Phantom KS107BD, low frequency, used when center frequency of the probe ≤ 4MHz;
Phantom KS107BG, high frequency, used when center frequency of the probe ≥5MHz;

5.5.2.1 Resolution

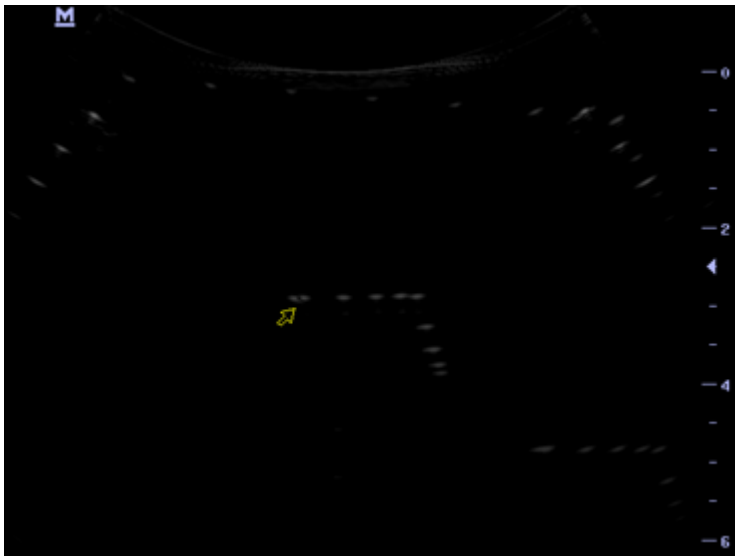
■ Lateral resolution

Test Procedure:

1. Place the probe head gently on the acoustic window of the phantom which is covered by water or gel, and make sure the lateral resolution targets are displayed in the center of the image.
2. Focus to the lateral resolution target group.
3. Adjust gain, dynamic range, TGC, etc., make sure only the target line is displayed clearly on the image with no tissue image in the background.

4. Read the separation between two target points that can be distinguished clearly, while keeping the transverse target group horizontal.
5. Repeat upper steps at other depth.

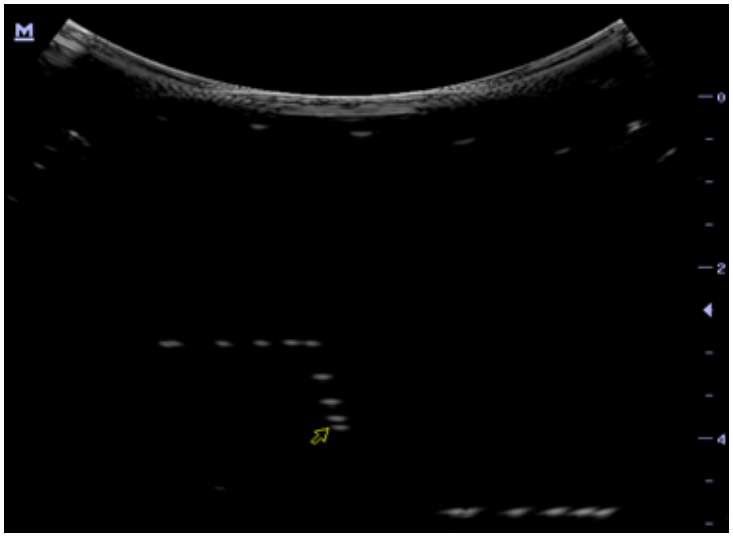
Image effect is show in figure below:



■ Axial resolution

Test Procedure:

1. Place the probe head gently on the acoustic window of the phantom which is covered by water or gel, and make sure the axial resolution targets are displayed in the center of the image.
2. Focus to the axial resolution target group.
3. Adjust gain, dynamic range, TGC, etc., make sure only the target line is displayed clearly on the image with no tissue image in the background.
4. Read the distance between two target points that can be separated clearly.
5. Repeat upper steps at other depth.



Note:	1.	For convex probe, keep the lateral resolution targets near the central line of the scanning plane.
	2.	For linear probe with Steer function, DO NOT turn on Steer when testing the transverse resolution.
	3.	Magnify (zoom) the targets for observation if necessary.
	4.	Distance between the left and right edges of a target point at a certain depth indicates the transverse resolution at this depth also.

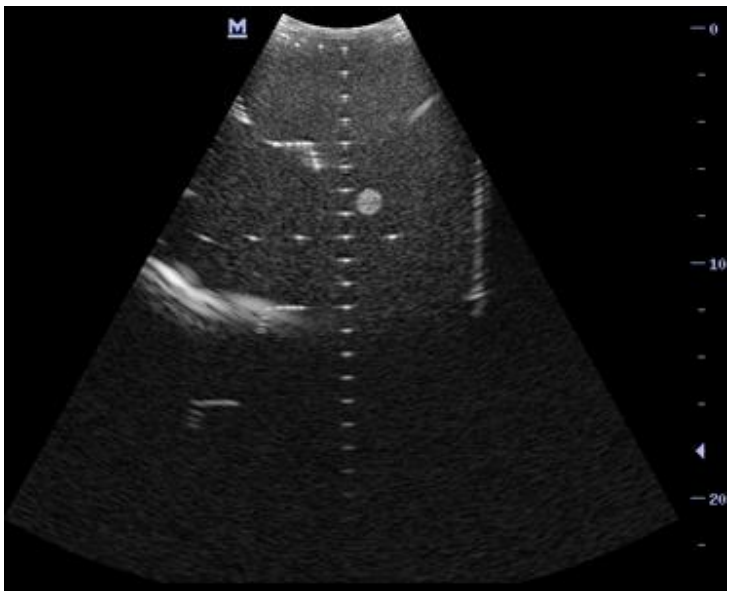
5.5.2.2 Maximum Detection Depth

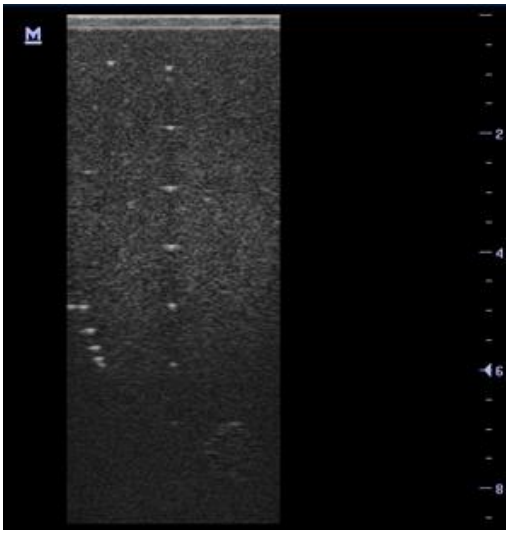
Test Procedure:

1. Place the probe gently on the phantom surface which is covered by water or gel.
2. Set displaying depth (according to the max depth of the current probe);
3. Adjust Focus to the deepest value, set AP value to largest.
4. Increase Gain, Contrast, TGC, but make sure no halos or defocusing appears.
5. Record the depth of the most distant target line which is imaged clearly.

Note:	1.	An overlarge gain may result in large noise and submergence of the echo signal.
	2.	For linear probe, the probe surface should be perfectly fit with the acoustic window on the phantom without any inclination during scan.
	3.	For convex and phased probe, make sure the axial target group is placed in the central of the scanning plane which keeps the justice of the interfering effect.
	4.	In non-frozen mode, a distant target may be similar to a noise dot which should be discarded.

Image effect is show in figure below:





5.5.2.3 Geometric Positioning Accuracy

■ Axial Geometric Positioning Accuracy

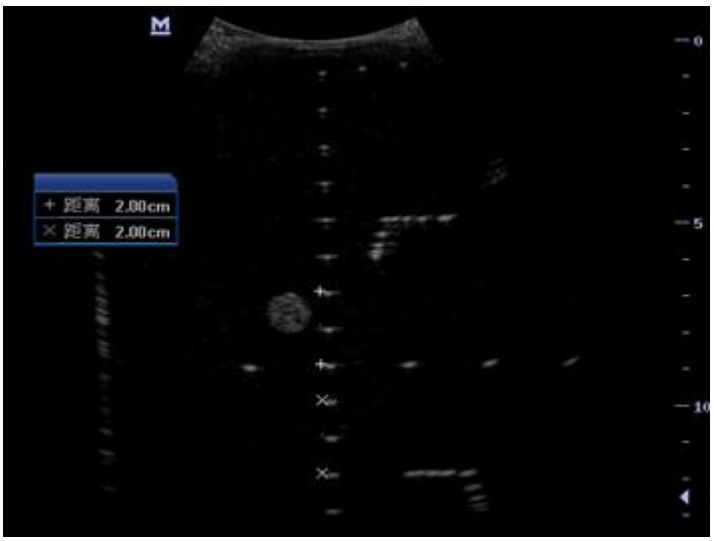
Test Procedure:

1. Adjusting steps are the same with the Maximum Detection Depth.
2. Record the separation values with measuring caliper in step of 20 mm on the axial target group.
3. Select all measurement values deviating largely from 20 mm, and calculate the error by the following formula.

$$\text{Geometric positioning accuracy}\ (\%) = \left| \frac{\blacksquare\ \text{value} - \text{actual D}}{\text{actual D}} \right| \times 100$$

Note:	1. Measuring cursor should be placed on the top edge of the target image, not in the middle or bottom edge. 2. Scan plane should be perpendicular to each target line, in other words, scan plane should be parallel to phantom section plane.

Image effect is show in figure below:



■ Lateral Geometric Positioning Accuracy

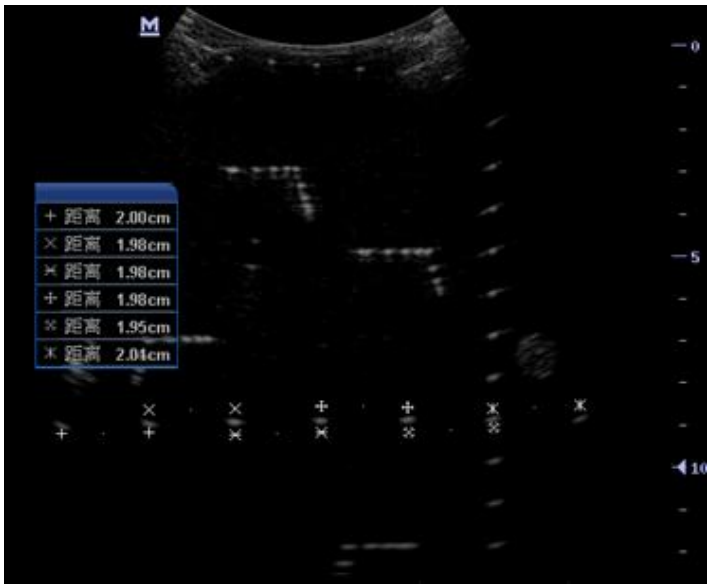
Test Procedure:

1. Place the probe gently on the acoustic window of phantom which is covered by water or gel.
2. Adjust display depth, to make horizontal groups display in the image.
3. Adjust focus to be in horizontal groups (no explicit standard).
4. Adjust gain, TGC, etc to make horizontal groups display clearly.
5. Use caliper to measure horizontal target distance by step of 20mm.
6. Select all measurement values deviating largely from 20 mm, and calculate the error by the following formula.

$$\text{Geometric positioning accuracy}\ (\%) = \left| \frac{\blacksquare\ \text{value} - \text{actual D}}{\text{actual D}} \right| \times 100$$

Note:	1. To linear array probe, read the lateral distance one segment after another. 2. For convex probe, display all lateral targets one time. 3. The measurement caliper lies at the top or bottom of the target to be measured.

Image effect is show in figure below:



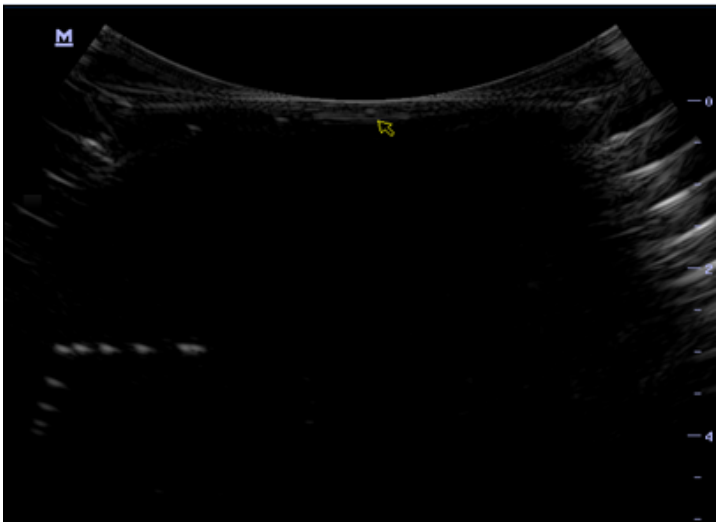
5.5.2.4 Blind Area

Test Procedure:

1. Place the probe gently on the phantom surface which is covered by water or gel.
2. Adjust the depth to lower value and set the focus to shallowest.
3. Reduce AP, Gain, etc until the background noise is barely visible.
4. Observe the depth of shallowest target image. It is also the blind area value.

Note:	1. For linear probe, the probe surface should be perfectly fit with the acoustic window on the phantom without any inclination during scan. 2. For convex probe, blind area target in the observation must lie on the central line of the scan plane.

Image effect is show in figure below:



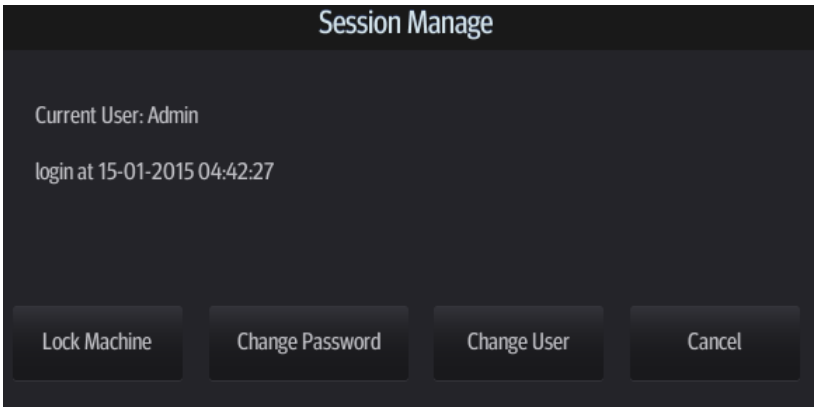
6 Software Installation & Maintenance

⚠WARNING: Do not perform hot swapping of USB device in case of data loss.

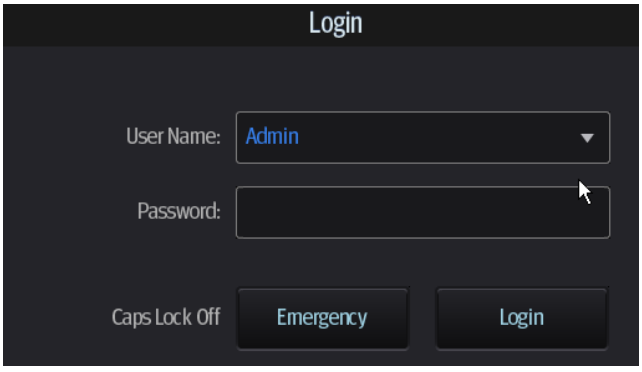
6.1 Enter Maintenance

Note: Before the maintenance operation, the engineer should login the system as Service.

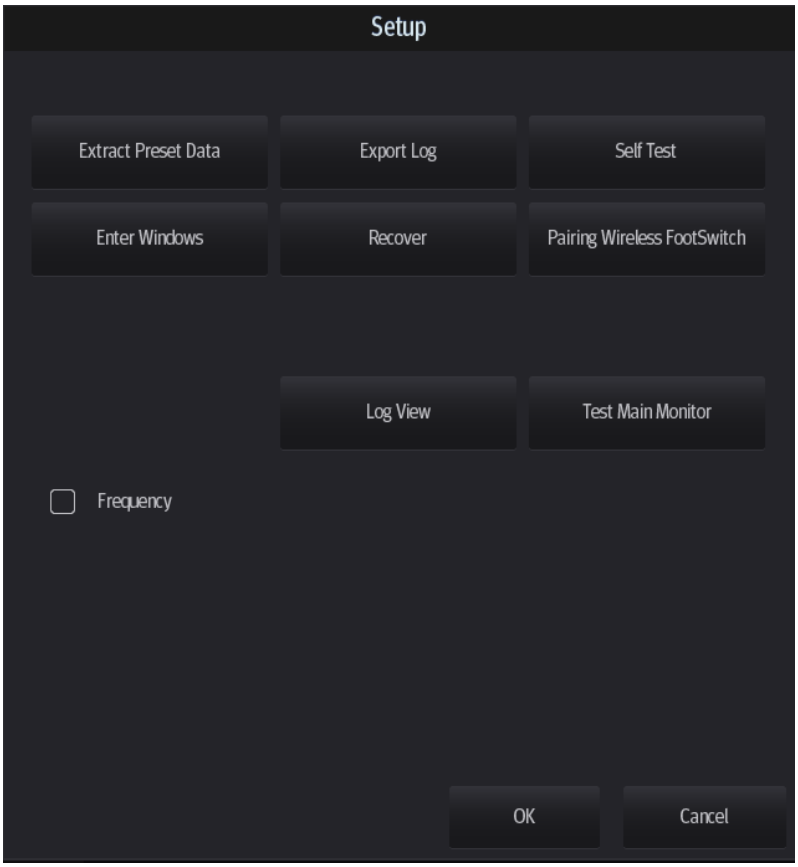
1. Tap in the top-right corner of the screen and select to bring up the following dialog box.



2. Tap [Change User] to bring up the Login dialog box.
   - Connect an external USB keyboard, press “ctrl”+“/” and select Service as the user name and input the password. Or
   - Enter 0755 password, and then select Service as the user name and input the password.



3. Log in with the account of Service and tap <Setup> to enter maintenance interface by taping [Setup]-[Maintenance].



6.2 Software Installation/Restoration

See *Software Recovery Guide* for detailed system operations and Doppler system restoration.

⚠WARNING:
1. **To avoid data loss, back up user's preset data and patient data before system restores.**
2. **Do Not cut off, shut down or restart the system in the restoration.**

6.3 Enter Windows

1. The password is generated by device Mac address and serial number (see System Information), please contact Mindray Service Department for details.
2. Enter maintenance menu. Tap [Enter Windows]. Type the password to enter Windows system.

6.4 Software Maintenance

6.4.1 Log Export

1. Insert the USB disk to the device;
2. Tap [Setup] interface; select [Export Log] to export the log.
3. Select the path in the Browse page to save the log, and then click [OK].
4. When the log is exported, the system prompts “Export succeed!”, click [OK] to return to Maintenance menu.

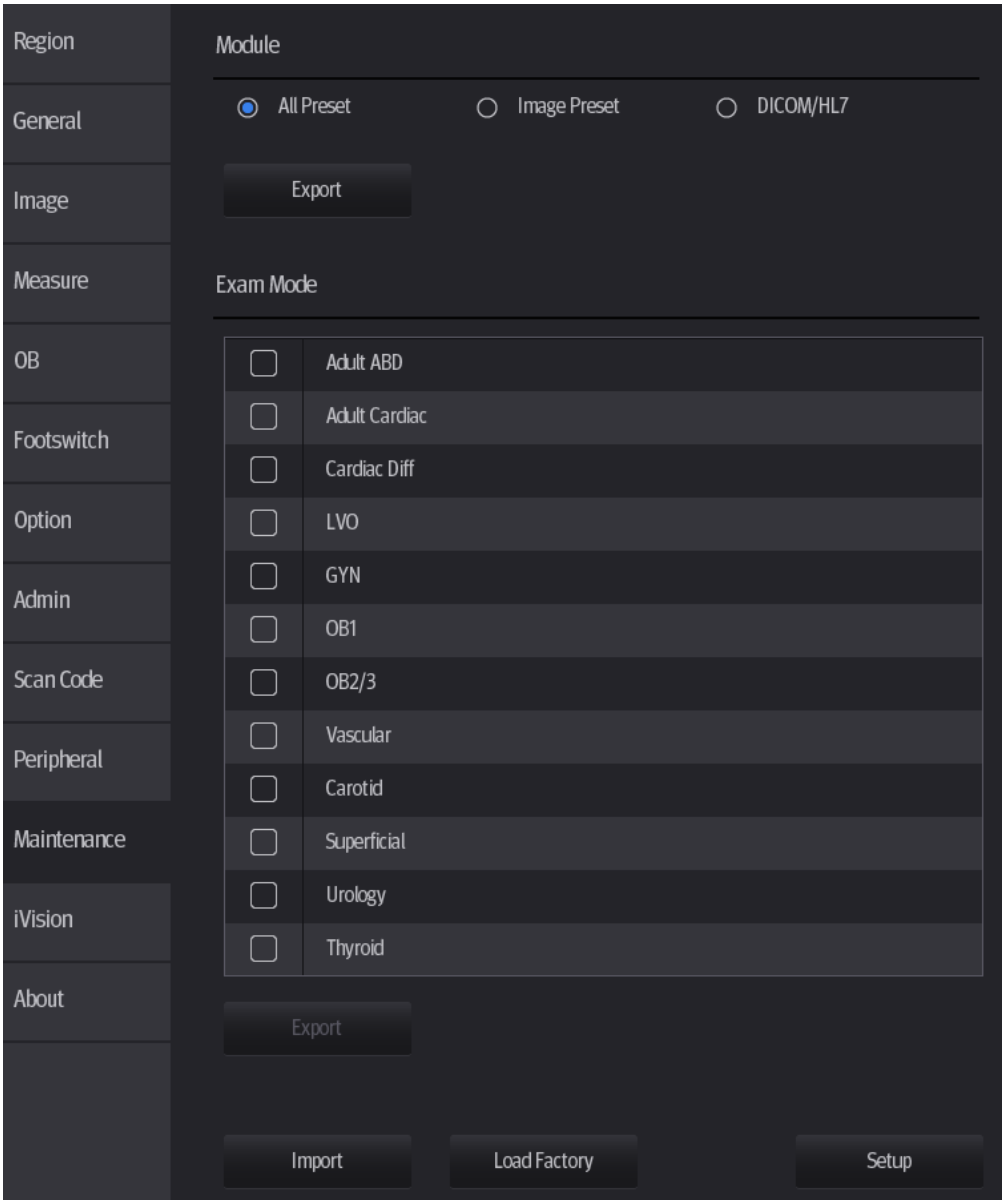
Note:	The log can be exported to the external USB storage device only. Make sure there is enough space for the storage before the exporting.

6.5 Data Backup and Storage

6.5.1 Preset Data Management

Tap in the top-right corner of the screen and select to enter the setup menu, and click [Maintenance].

Export and import system preset data or load the factory.



6.5.1.1 Back up the Setup Data

1. Click [Export] to open the [Export Data] dialogue box on "Module" list.
2. Select the path to save data.
3. Click [OK]. A progress bar appears and the setup data of the selected item is exported to the specified path.

6.5.1.2 Restore the Setup Data

1. Click [Export] to open the [Export Data] dialogue box on “Maintenance” interface.
2. Select the path to import the data. Select path to import all data or some of the data;
3. Click [OK], a progress bar appears and the setup data is imported to the specified module.

Tip: If select [Load Factory], the settings are restored to the factory defaults, except for region preset and admin.

6.5.2 Patient Data Backup and Restoration

6.5.2.1 Patient Data Backup

1. Press [iStation] on the control panel to open the iStation dialogue box;
2. Select the check box in front of the "ID" to select all data or select the desired data one by one;
3. Select the information. Click [Backup Exam] to pop up the “Backup Patient Record” dialogue box. Select the desired storage device (recorder, DVD or USB disk). Click [Backup]. Back up the selected data automatically.

NOTE	Only backup the exam that is not active.

6.5.2.2 Restore Backup Patient Data

1. Press [iStation] on the control panel to open the iStation dialogue box;
2. Select the drive which contains the patient data. Click [Select All] to select all the data or select the target data one by one. Click [Restore] to restore the patient data from the current drive to the patient database.

6.6 Introduction on HDD Partition Data

1. The whole capacity is 120 G. The details are shown as follows:

Notes	Blocks(G)	Notes
C:	30G	NTFS
D:	85G	NTFS
E:	5G	NTFS

2. Data distribution in each drive is shown as follows:

a) D drive

Data directory of Drive D		Data	Description
D:\M6	\gui	\word	User-defined library
	\PATIENTDATA	\	Patient database path
	\Preset	\Current	User preset data
	\temporary	\	Temporary file directory
	\ScreenSaver		Screensaver
	\Log\Crash		Dump file directory
	\DICOMRevFiles		Temporary file backed up by DICOM
	\Log		Log file
		\DcmLog	DICOM log
	Userconfig		User infofmation file

b) E drive

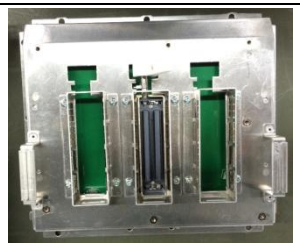
Directory structure of saved data in E Drive.		Data	Description
E:\M6	PatientBack		Patient data backup
E:	\Demo		Demo file

7 Field Replaceable Unit

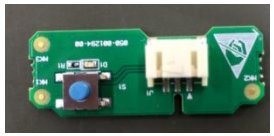
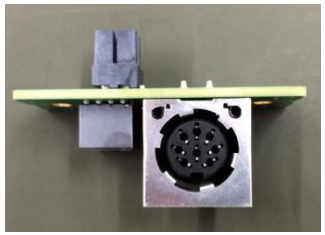
The chapter describes the detailed information of units, which can be replaced in the system scene.

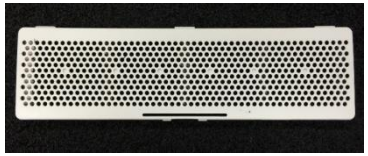
7.1 Main Unit

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
1.	Main unit front cover	115-031749-00		Including: front cover, display, touchscreen, inverter board	8.2.5
2.	Main board assembly	115-031751-00		Including radiator assembly	8.2.8

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
3.	PC module assembly	115-031752-00		Including the radiator	8.2.8
4.	PHV board assembly	051-001525-00		/	8.2.8
5.	Speaker assembly	020-000031-00		/	8.2.5
6.	Single probe board assembly	115-024819-00		/	8.2.6

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
7.	Three-probe board assembly	115-024815-00		/	8.2.6
8.	Fan	024-000588-00		Includeing five fans, should be replaced together	8.2.5
9.	Wireless net adapter	023-000569-00		/	8.2.7
10.	Probe connecting board	051-001527-00		/	8.2.8
11.	Touchscreen control board	051-001816-00		/	8.2.8
12.	LED indicator board	051-001531-00		/	8.2.5

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
13.	Keyboard	051-001530-00		/	8.2.4
14.	Adapter connecting board	051-001529-00		/	8.2.8
15.	Battery connecting board	051-001528-00		/	8.2.4
16.	Back cover assembly of main unit with three-probe	115-024816-01		/	8.2.4
17.	Back cover assembly of main unit with single probe	115-024820-01		/	8.2.4

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
18.	SSD (TE7/CE/maintenance spare)	115-031754-00			8.2.7
	SSD (TE7/FDA/maintenance spare)	115-031755-00			
19.	Dust-proof mesh	115-024818-00		/	8.2.2
20.	Battery cover assembly	115-024817-00			8.2.3
21.	Adapter	022-000187-00		/	/
22.	Li-ion battery FRU (CE)	115-023405-00		Includeing Two batteries, should be replaced together	8.2.3
	Li-ion battery FRU (FDA)	115-023072-00			

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
23.	ECG module	115-029586-00		/	8.2.9

7.2 Mobile Trolley

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
1	Cable reel assembly (European standard power cord/FRU)	115-031763-00			8.3.10
	Cable reel assembly (British standard power cord/FRU)	115-031764-00			
	Cable reel assembly (American standard	115-031765-00			

No.	Material Name	Order Number	Picture	Remarks	Disassembly Reference
	power cord/FRU)				
	Cable reel assembly (Brazilian standard power cord/FRU)	115-031766-00			
2	2121 Trolley power adapter 19 V 150 W	022-000194-00		/	8.3.10
3	Wet tissue holder	043-003916-00		/	8.3.2
4	The caster assembly of the trolley	115-031761-00		Wrench equipped	8.3.12

8 Structure and Assembly/Disassembly

8.1 Structure of the Entire System

8.1.1 Main Unit

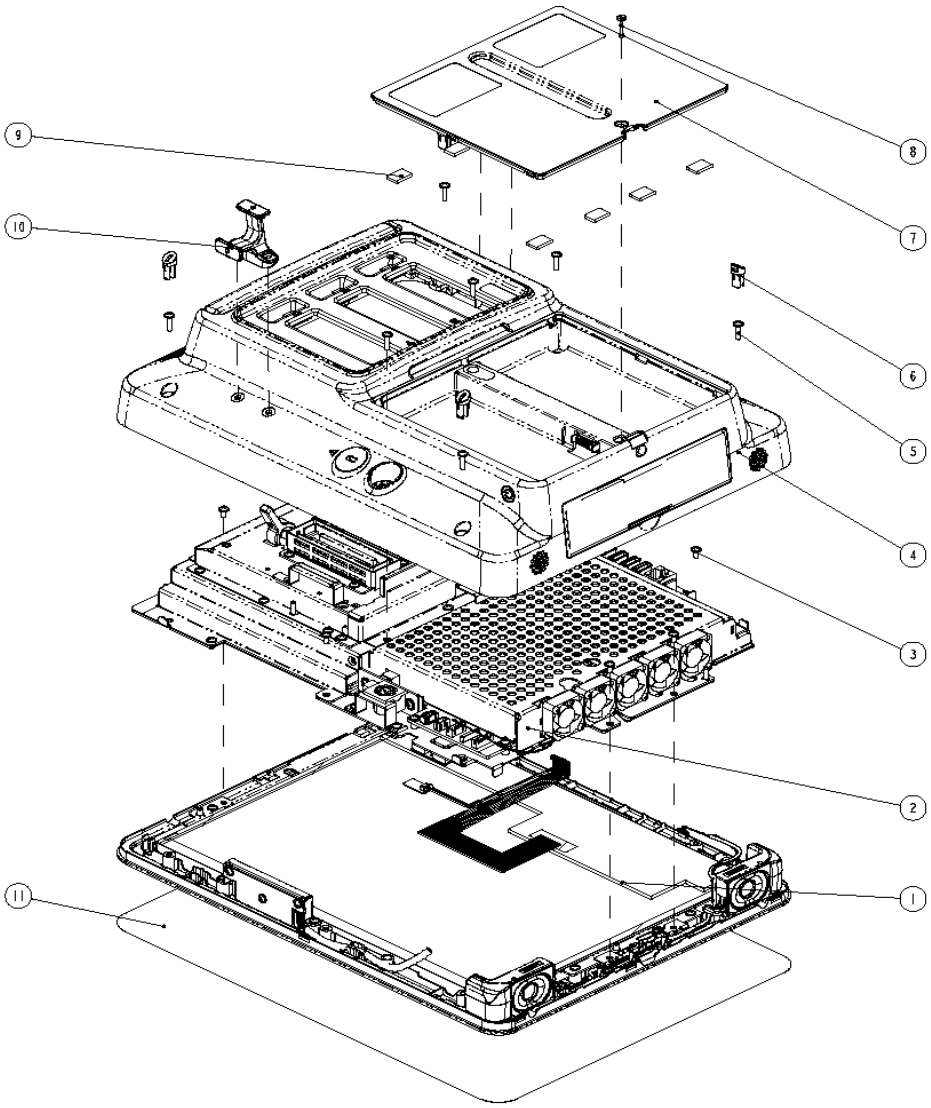


Figure 1 Explosion View of the Main Unit

No.	Name	No.	Name
1.	Front cover assembly of main unit	2.	Machine assembly
3.	M3 X 6 panhead screw with washer	4.	Back cover assembly of main unit
5.	M3 X 12 panhead screw with washer	6.	Screw cap on main unit
7.	Battery compartment cover	8.	M3 X 15 captive fastener with the slot
9.	Press pad for battery	10.	Probe holder bracket
11.	The protective film of the display		

8.1.2 Mobile Trolley

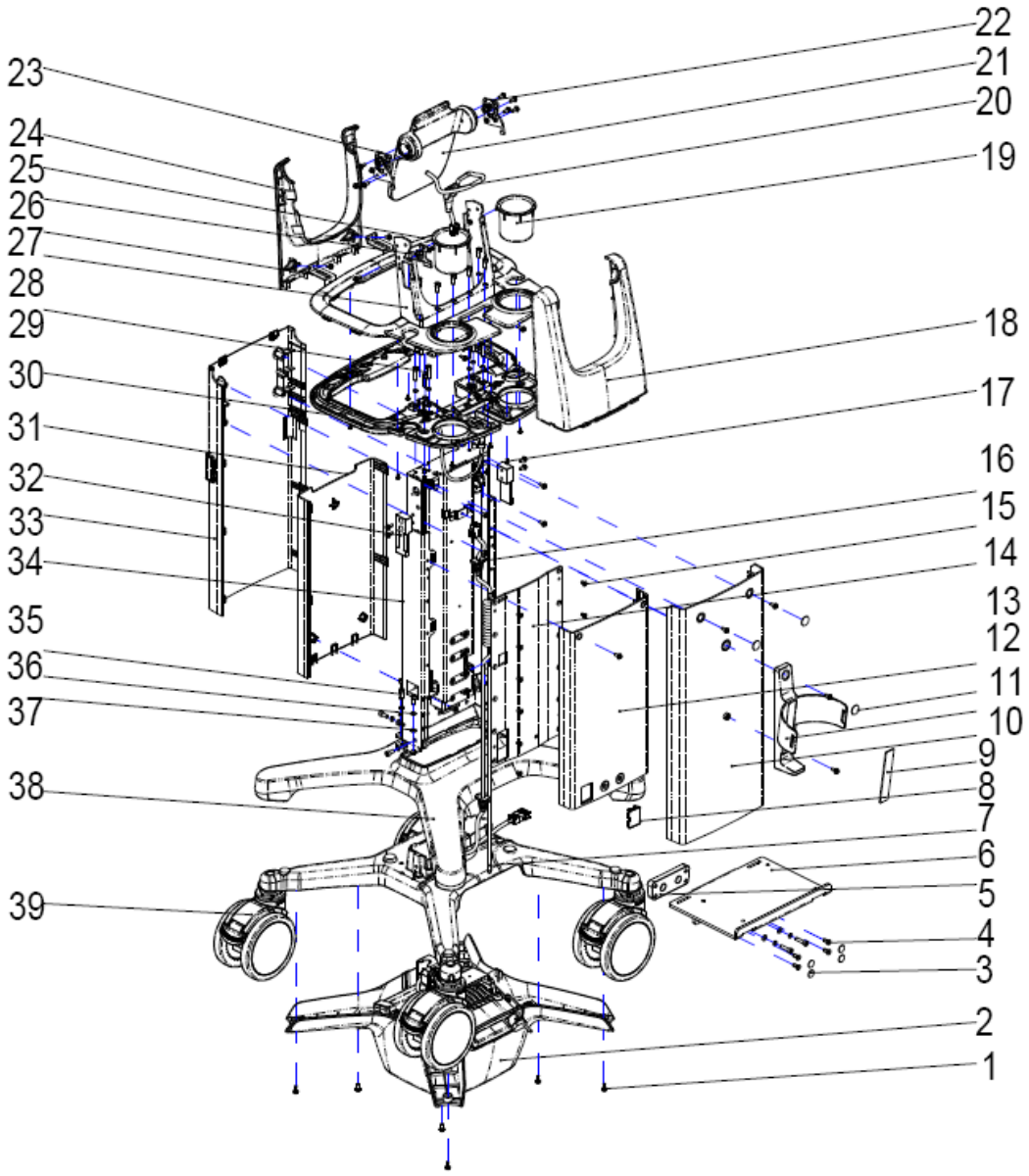
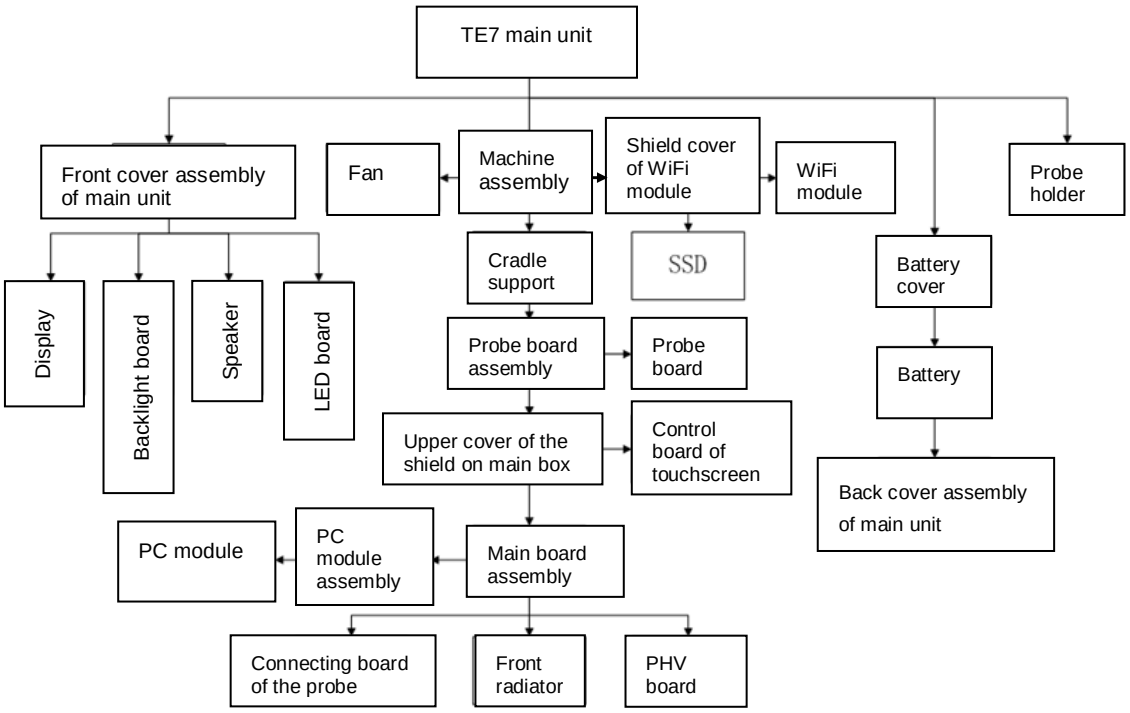


Figure 2 Explosion View of the Mobile Trolley

No.	Name	No.	Name
1.	Cross small combination screws M4 X12 (the washer customized). Color-zinc plated.	2.	Cable reel assembly (Chinese power supply cable)
3.	Screw cover	4.	Stainless steel socket cap screw GB/T70.3-2000M5X12 polished
5.	Printer support frame	6.	TE7 printer tray
7.	Guide rod of the spring	8.	Cover of auxiliary output
9.	Mat of wet tissue holder	10.	Back cover of upper stand
11.	Wet tissue holder	12.	Screw label sticker
13.	Back cover of lower stand	14.	Cover plate
15.	Stainless steel Philips sunk head screw M4 X 8 passivation	16.	Spring wire for main unit's power supply
17.	Cross panhead combination screw M3X8 color-zinc plated.	18.	Back cover of the support
19.	Probe holder to the trolley	20.	AC input cable of main unit
21.	Main unit support	22.	Left damper shaft
23.	Right damper shaft	24.	Front cover of the support
25.	Upper cover of trolley's handle	26.	Cable hook
27.	The adapter of front cover	28.	Bracing frame
29.	Steelless inner head screw M5X20 passivation	30.	Lower cover assembly of trolley's handle
31.	Front cover of lower stand	32.	Fixing plate of the storage tray
33.	Front cover of upper stand	34.	Stand assembly
35.	Inner head screw M5X12 color-zinc plated	36.	Standard spring washer color-zinc plated
37.	Flat washer color-zinc plated	38.	Upper cover of the base
39.	The caster assembly of the trolley	40.	Velcro tape of the printer
41.	Velcro tape of wet tissue container		

8.2 Main Unit Assembly/Disassembly

This section describes the disassembling and assembling of the main parts and hardware boards. The assembling is the inverse process of disassembling if not mentioned in particular.



Note:	The illustration of disassembly is for reference only; please relies on the actual model.

8.2.1 Preparation

8.2.1.1 Disassembly Tools Required

Name	Type	Material No.	Remarks
Cross-headed screwdriver	107*75	/	M2.5
Cross-headed screwdriver	107*75	0000-10-10884	M3、M4
Flatheaded screwdriver	8#	042-007605-00	M3 X 15 captive fastener with the slot
Anti-electrostatic glove: 1 pair.	/	/	/

8.2.1.2 Engineers Required

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform maintenance and check.

8.2.1.3 Disassembly Requirements

You should perform the following preparations before the disassembling of ultrasound device.

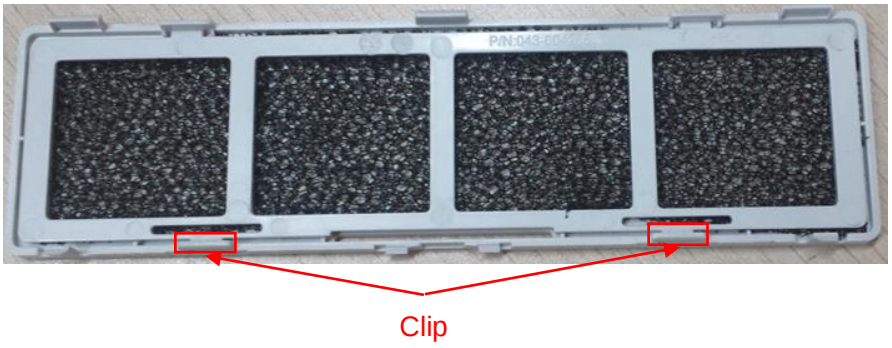
1. Stop scanning the patient and capturing images. Shut down the device and cut off AC power supply. Unplug AC power supply cable.
2. Keep the main unit on a stable platform from moving in the disassembly;
3. Prepare the tools required.

NOTE	● It is recommended to remove the battery first, and the remove other parts when the power supply is cut off. ● It is necessary to wear the anti-electrostatic glove when dissembling the ultrasound device.

8.2.2 Dust-proof Mesh

1. Release the clip of the dust-proof mesh outwards (on back cover of main unit), and remove the mesh.

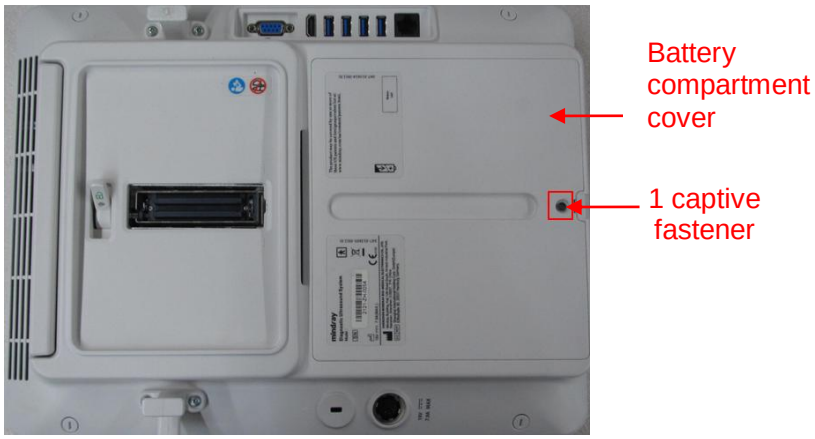
2. Release the clips outwards, remove the frame, and take out the dust-proof of the mesh.



8.2.3 Battery

The disassembly tool: flat-headed screwdriver.

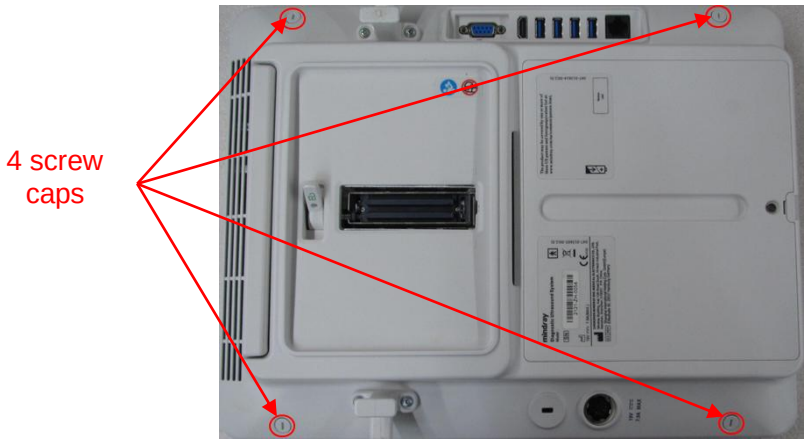
Unscrew 1 captive fastener, and remove the cover of battery compartment and 2 batteries.



8.2.4 Back Cover Assembly of Main Unit

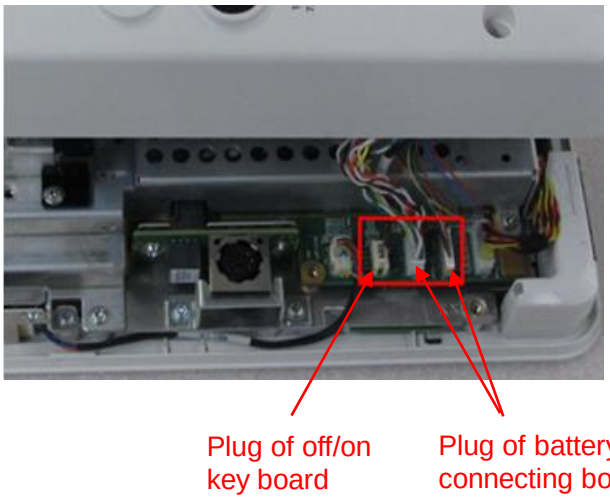
The disassembly tool: flat-headed screwdriver, cross-headed screwdriver (M3, M4)

1. Remove the battery. See *chapter 8.2.3*
2. Unscrew 4 caps with flat-headed screwdriver.

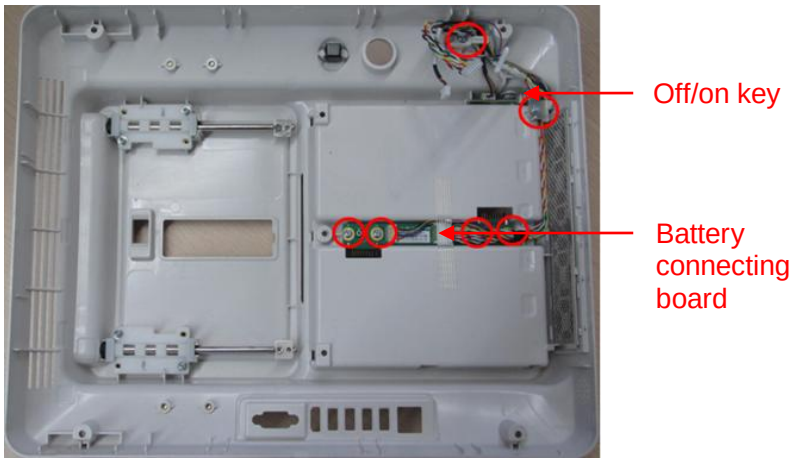


3. Unscrew 7 M3 X 12 screws with cross-headed screwdriver, and remove the back cover of the main unit.

4. Pull the plugs out of the battery connecting board and off/on key board, and remove the back cover assembly of main unit.



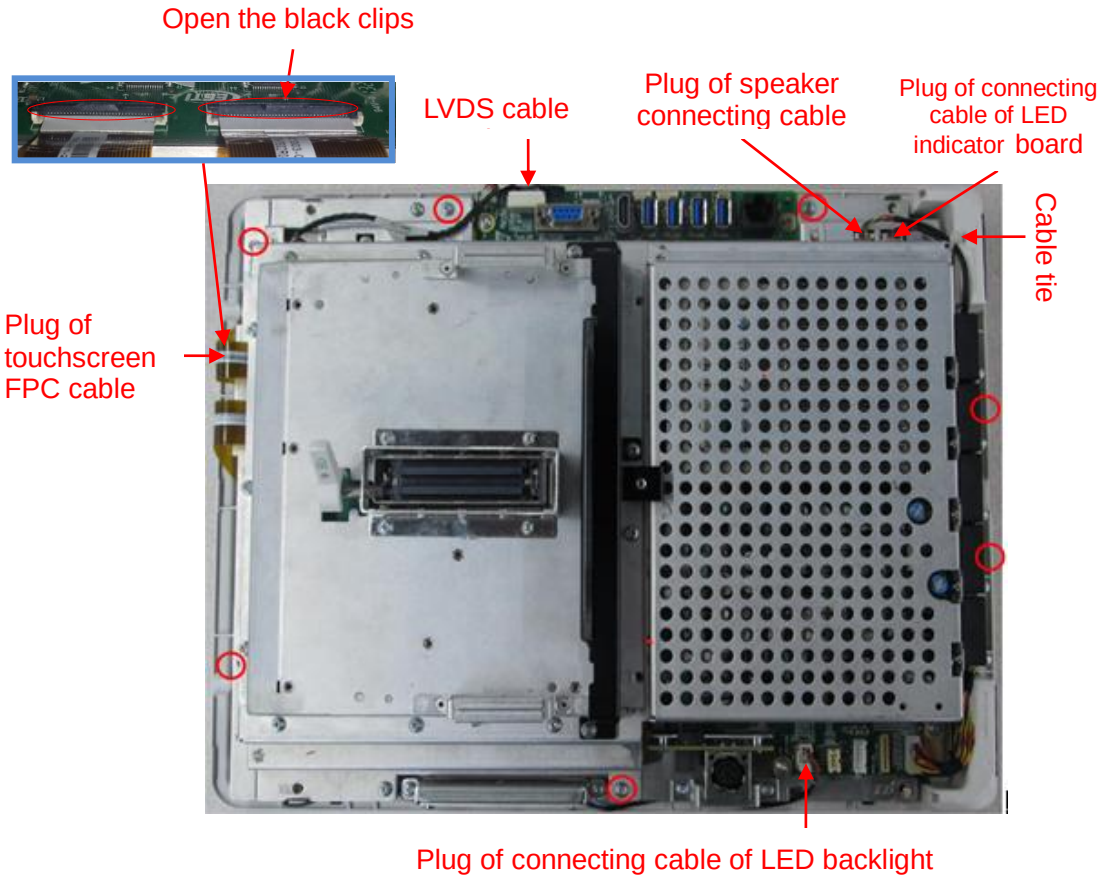
5. Unscrew 6 M3 X 6 screws with cross-headed screwdriver, and remove the battery connecting board and off/on key board.



8.2.5 Front Cover Assembly of Main Unit

The disassembly tool: cross-headed screwdriver (M3, M4).

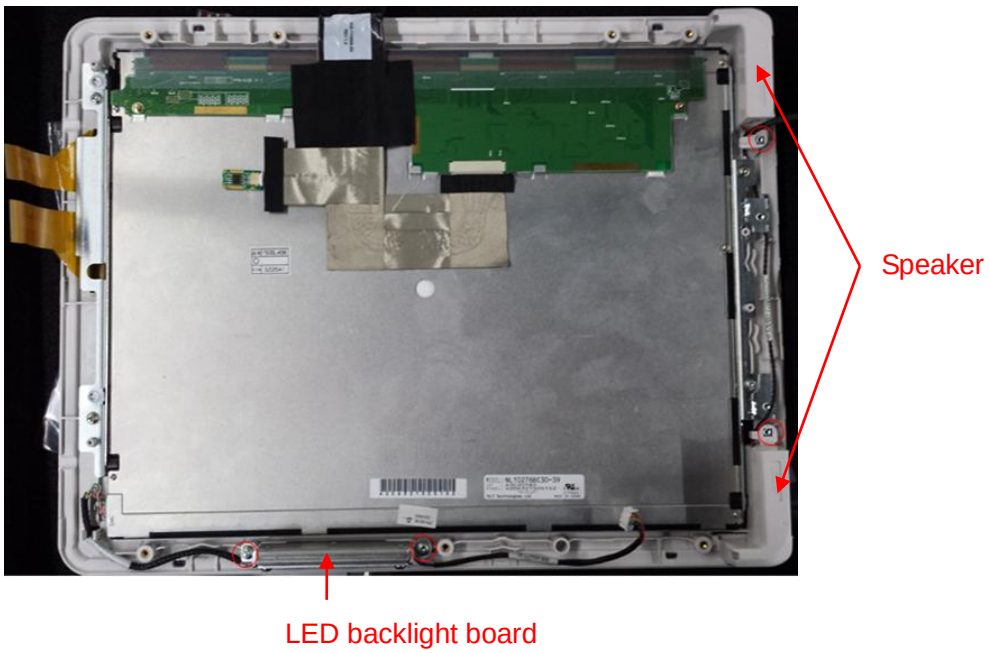
1. Refer to step 1 to 4 in chapter 8.2.4 after disassembling the back cover assembly of the main unit.
2. Unscrew 7 M3 X 6 screws. Pull the each plug to touchscreen FPC cable (open the black clips), to LVDS cable, to speaker cable, LED indicator connecting cable and to LED backlight cable. Cut the cable tie (fixing the speaker connecting cable and connecting cable of LED indicator board) off and take the machine assembly and front cover out.


Open the black clips
LVDS cable
Plug of speaker connecting cable
Plug of connecting cable of LED indicator board
Cable tie
Plug of touchscreen FPC cable
Plug of connecting cable of LED backlight

3. Unscrew 10 M3 X 14 screws from machine assembly, and pull the fan's plug out, then remove the fan.

4. Unscrew 2 M3 X 6 screws from front cover assembly of main unit, and remove LED backlight board.

   Unscrew 2 M3 X 8 sheet-metal screw, and remove the speaker.



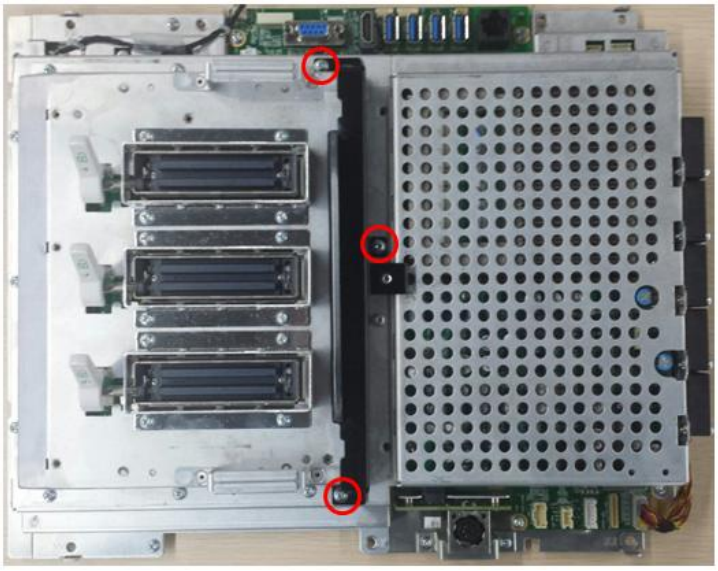
5. Release the clip outwards, and pull the connecting cable of LED indicator board, then pull LED indicator board upwards.

8.2.6 Probe Board Assembly

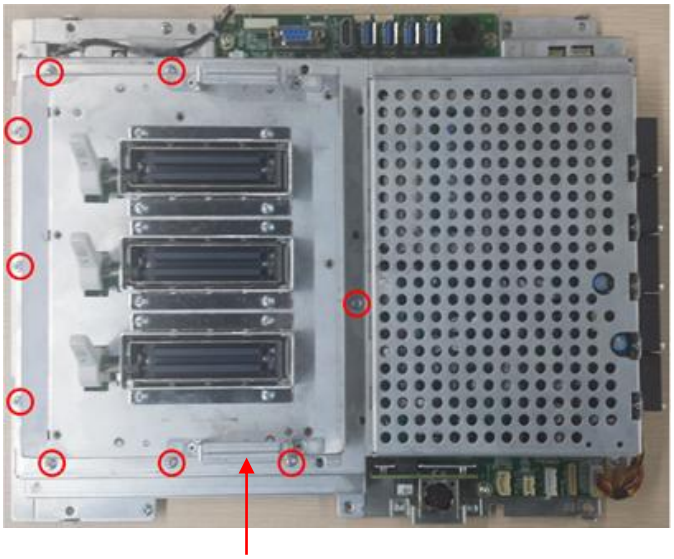
Here take the disassembly of three probes as the example. The disassembly of single probe is the same with three probes'.

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Disassemble the machine assembly. Refer to step 1 to 2 in *chapter 8.2.5*.
2. Unscrew 3 M3 X12 screws, and remove Cradle frame.



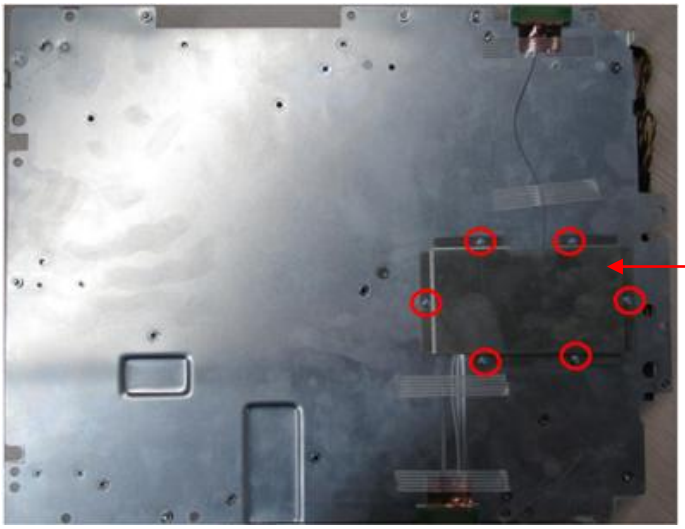
3. Unscrew 9 M3 X6 screws, and hold the handle of the probe assembly and pull it upwards. Remove the probe assembly.



8.2.7 SSD and Wireless Adapter

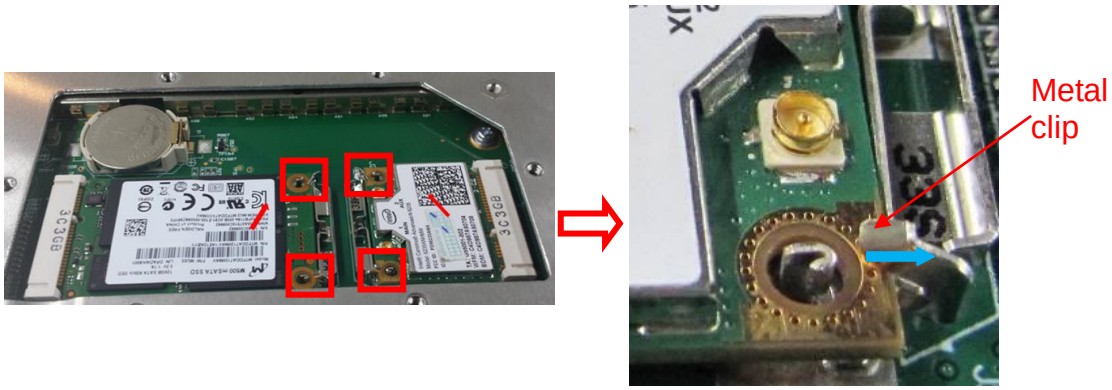
The disassembly tool: cross-headed screwdriver (M3, M4).

1. Remove the probe board assembly. See *chapter 8.2.5*.
2. Rotate the machine assembly 180°, and unscrew 6 M2.5 X 6 screws, take the shield cover of WiFi module out.



3. Pull the plug of WiFi connecting cable upwards.

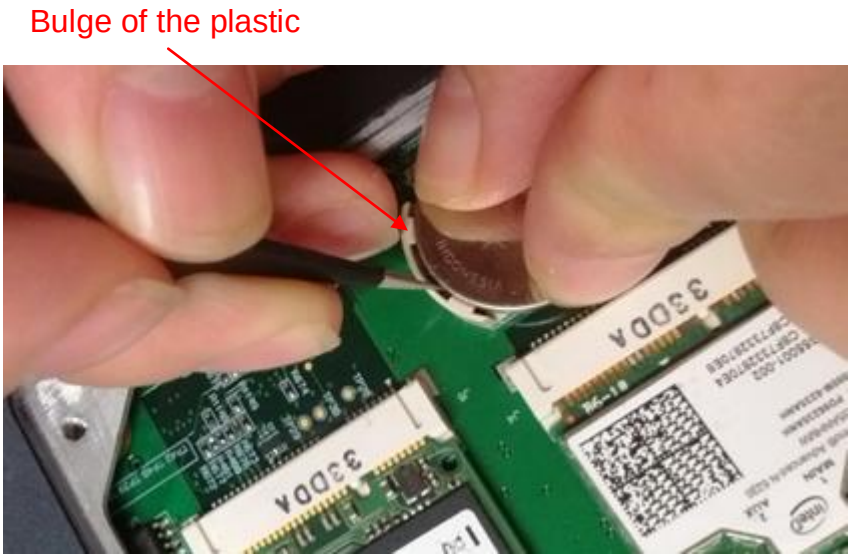
4. Push the metal clip backwards following the arrow's direction. SSD card and WiFi module will be fallen out, then remove SSD card and wireless adapter.



5. Remove button battery

   Hold the button battery gently. Put the sharp end of the tweezer or flat-headed screw into the gap between battery and bulges of plastic cover. The button battery bounces off then.

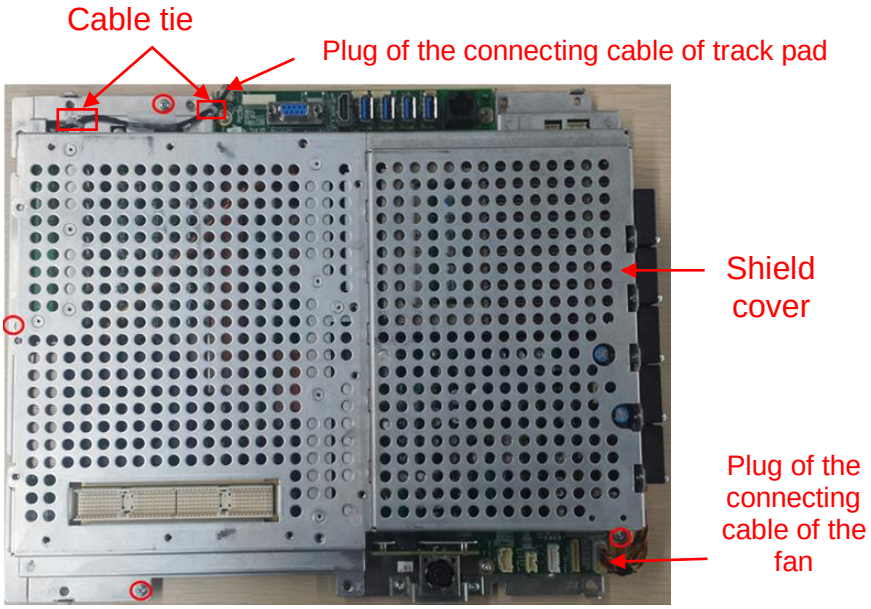
Note: do not press hard in the operation.



8.2.8 Main Board Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Remove the probe board assembly. See *chapter 8.2.6*.
2. Unscrew 4 M3 X 6 screws, cut off two cable ties (fixing the connecting cable of track pad), pull the plug of the connecting cable of track pad, and the plug of the connecting cable of the fan. Remove the shield cover of main unit box.

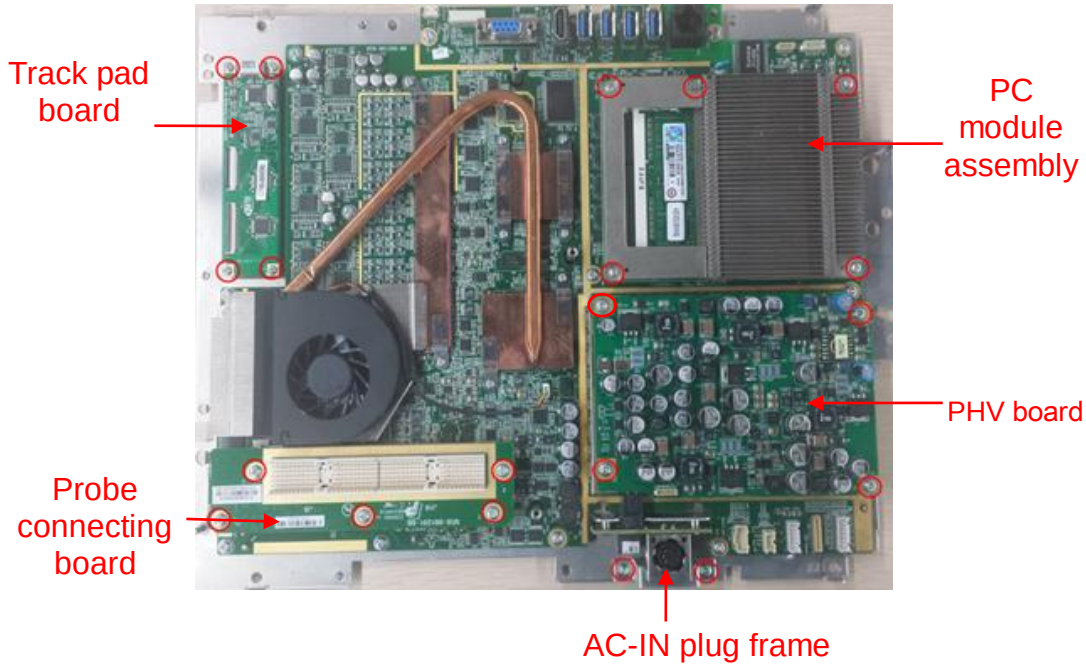


3. Unscrew 4 M2.5 X 6 screws, and remove the track pad board;
   Unscrew 5 M2.5 X 12 screws, and remove PC module assembly;

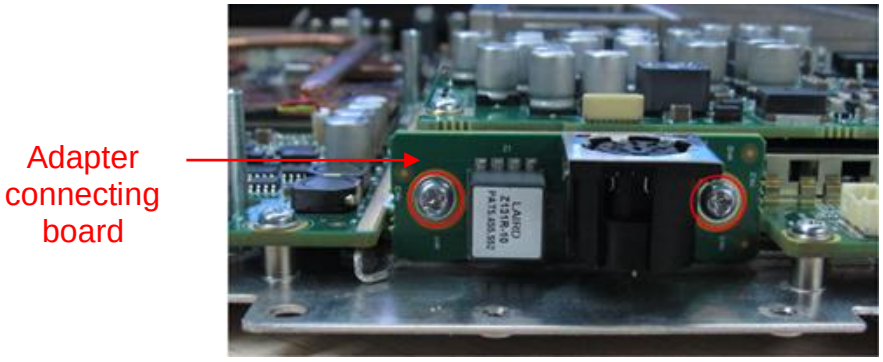
Unscrew 4 M3 X 6 screws, and remove PHV board;

Unscrew 5 M3 X 6 screws, and remove probe connecting board;

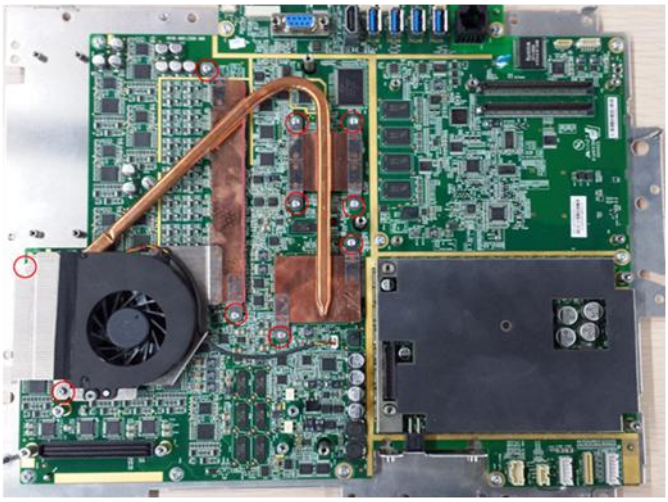
Unscrew 2 M3 X 6 screws, and remove AC-IN plug frame.



Unscrew 2 M3 X 6 screws, and remove adapter connecting board.

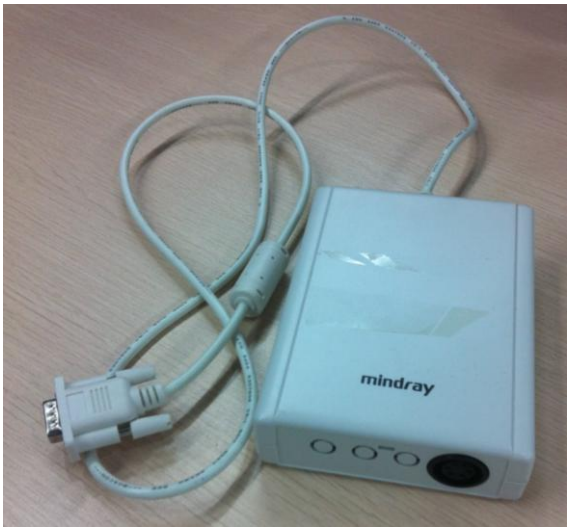


The rest is the main board assembly.



8.2.9 ECG module

ECG is an external module which is connected with the serial port on the rear of the main unit when using.



8.3 Trolley Assembly/Disassembly

8.3.1 Preparation

8.3.1.1 Disassembly Tools Required

Name	Type	Material No.	Remarks
Cross-headed screwdriver	107*75	/	M2
Cross-headed screwdriver	107*75	0000-10-10884	M3、M4

Name	Type	Material No.	Remarks
Inner hexagon spanner	369H(1.5-6.0mm)	095-000062-00	M5
Spanner	1PK-H024	095-000063-00	4″
Diagonal cutting pliers	N-206S	095-000077-00	/
Anti-electrostatic glove: 1 pair.	/	/	/

8.3.1.2 Engineers Required

Only technical professionals from Mindray or engineers authorized by Mindray after training can perform maintenance and check.

8.3.1.3 Disassembly Requirements

You should perform the following preparations before the disassembling of ultrasound device.

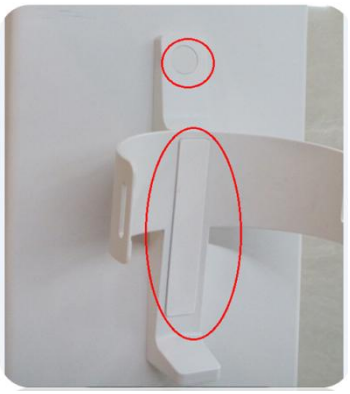
1. Stop scanning the patient and capturing images. Shut down the device and cut off AC power supply. Unplug AC power supply cable.
2. Lock the caster from moving in the disassembly;
3. Prepare the tools required.

8.3.2 Wet Tissue Holder

The disassembly tool: cross-headed screwdriver (M3, M4), knife.

1. Release the Velcro tape to remove the wet tissue container.

2. Remove the cover over the screw and the mat of the wet tissue holder with the knife.

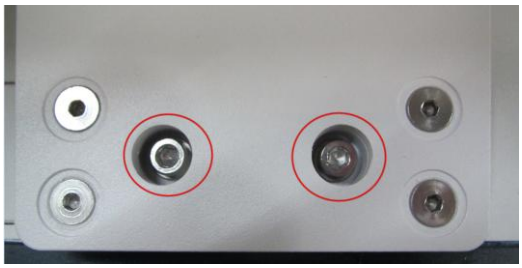


3. Unscrew 2 M4 X 12 combination screws to remove the wet tissue holder.

8.3.3 Printer

The disassembly tool: inner hex wrench (M3, M4), cross-headed screwdriver (M3, M4), knife.

1. Unscrew 2 M5 X 20 screws with inner hex wrench (M4) to remove the printer and the holder.



2. Unscrew 4 M3 X12 screws on the back of the support with cross-headed screw (M3, M4).

3. Remove 2 Velcro tapes to take out the printer.

8.3.4 Upper Cover of Trolley's Handle

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Unscrew 10 M3 X 8 screws on the upper cover of trolley's handle.

2. Split the upper cover and lower cover.

3. The screwdriver goes inside the gap (M3, M4), and split the upper cover gently.

NOTE	In case of the damage to the cover, do not split it by force.

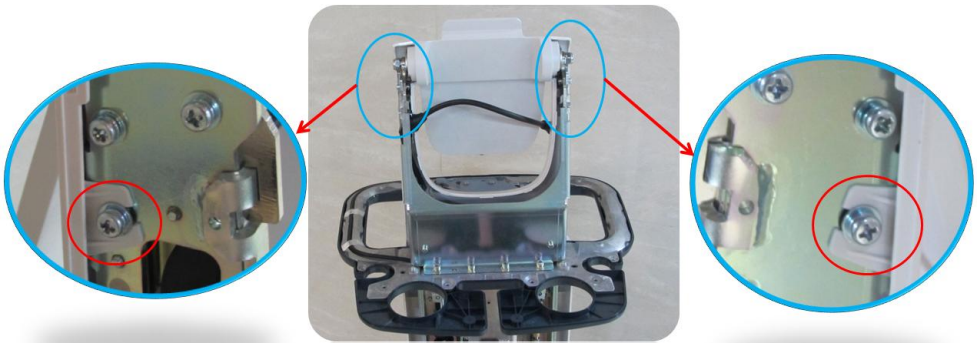
8.3.5 Main Unit Support

The disassembly tool: cross-headed screwdriver (M3, M4).

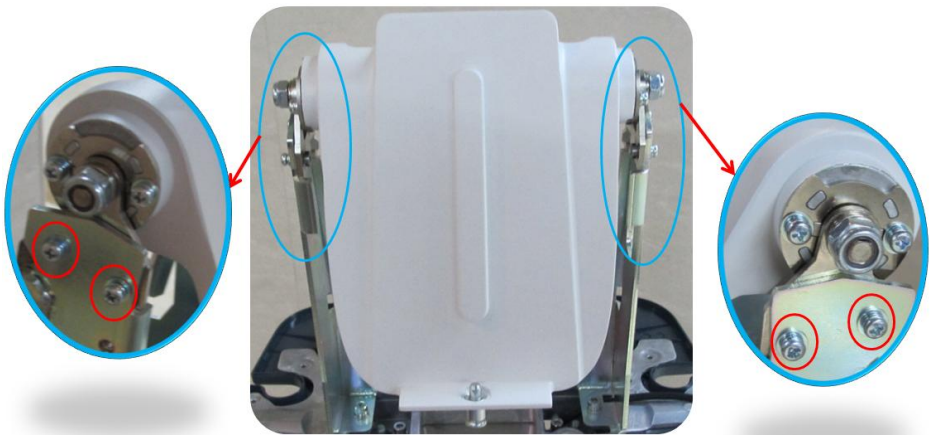
1. Remove the upper cover of the trolley's handle. See *chapter 8.3.4*.
2. It is unnecessary to loosen the screws. Hold two sides of the back cover as shown in the figure below. Pull the back cover towards arrow's direction.

   (Note: hold the back cover tightly to avoid falling of the cover from hands.)

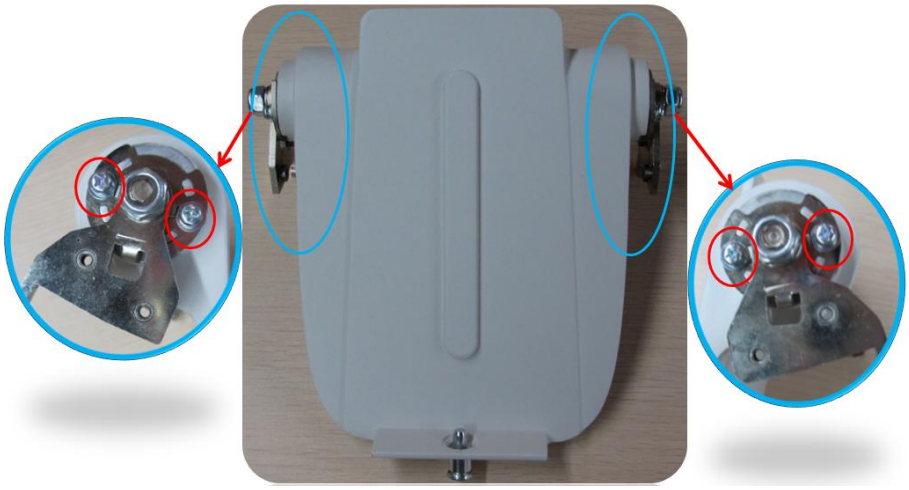
3. Unscrew 2 M4 X 12 screws on each left and right side to remove the back cover of the support.



4. Unscrew 4 M4 X 12 screws on each left and right side.



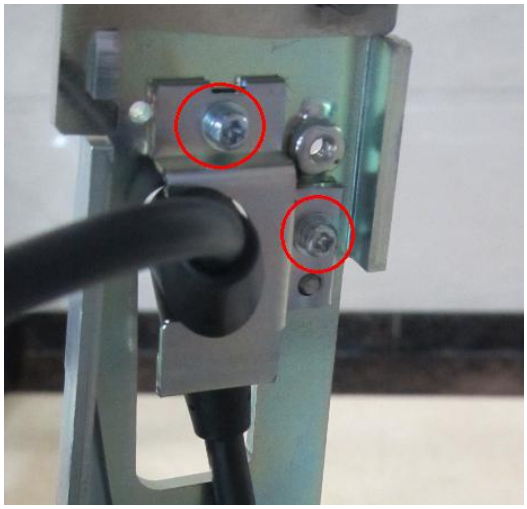
5. Unscrew 4 M4 X 12 screws on each left and right side to remove the support.



8.3.6 Support

The disassembly tool: cross-headed screwdriver (M3, M4), inner hex wrench (M5).

1. Remove the support of the main unit. See *chapter 8.3.7*.
2. Unscrew 2 M3 X 8 screws with cross-headed screwdriver (M3, M4).

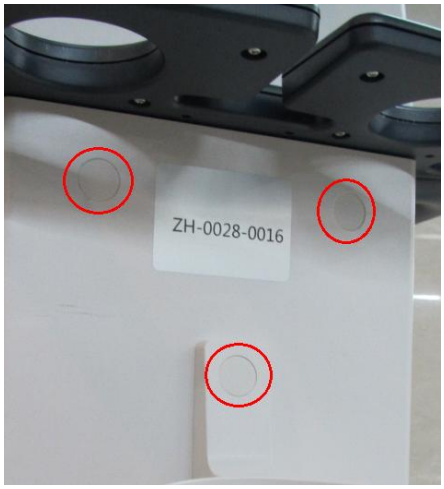


3. Unscrew 6 M5 X 12 socket head cap screws with Allen wrench (M5) to remove the support.

8.3.7 Front/Back Cover of the Stand

The disassembly tool: cross-headed screwdriver (M3, M4), knife.

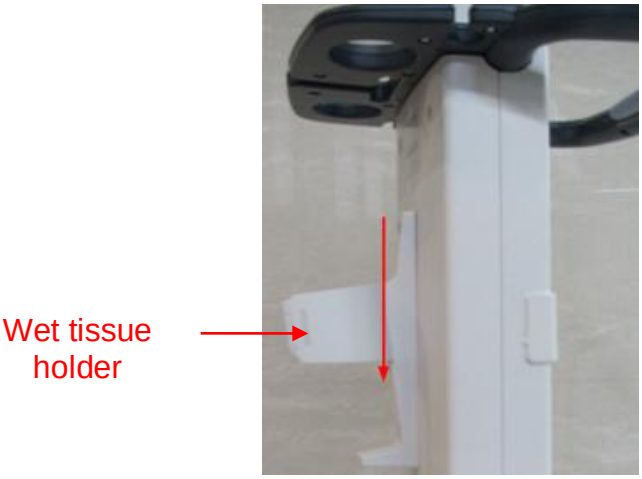
1. Release the three covers with the knife.



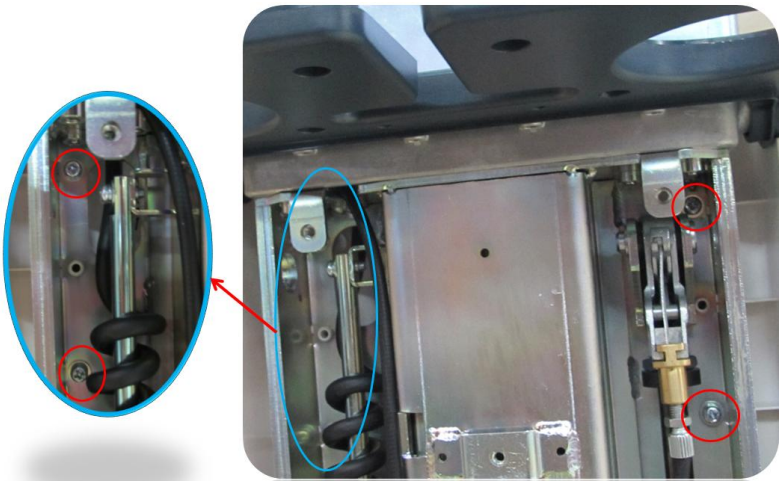
2. Unscrew 3 M4 X 12 screws.

3. Pull the wet tissue holder towards arrow's direction, and take out the back cover of the stand.

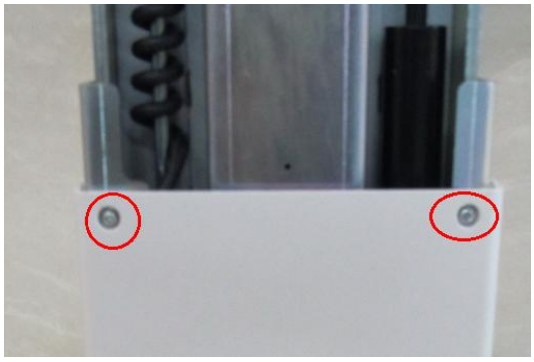
NOTE	In case of the damage to the wet tissue holder, do not pull it outwards when removing it downwards.



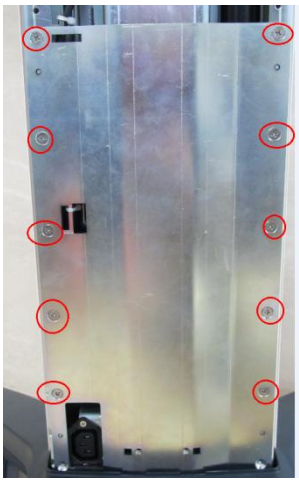
4. Unscrew M4 X 12 screws to remove the front cover of the stand.



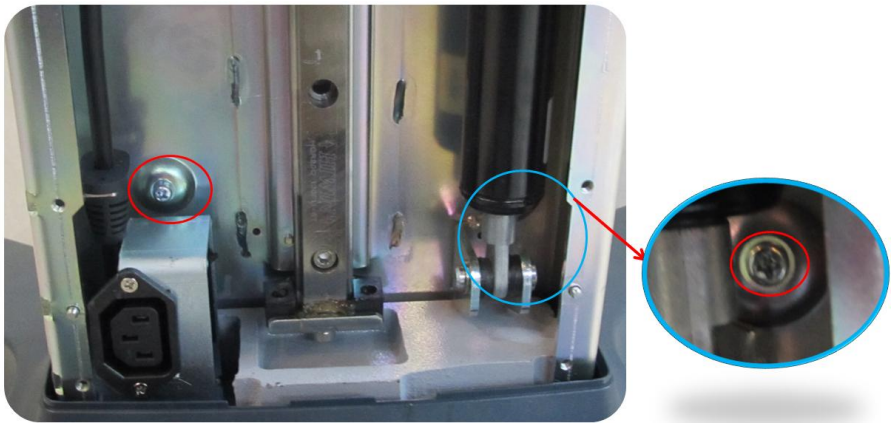
5. Unscrew 2 M4 X 12 screws to remove the back cover of the stand.



6. Unscrew 10 M4 X 8 cross slot screws to remove the cover.



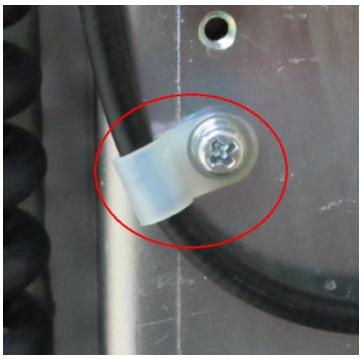
7. Unscrew 2 M4 X 12 screws to remove the front cover of the stand.



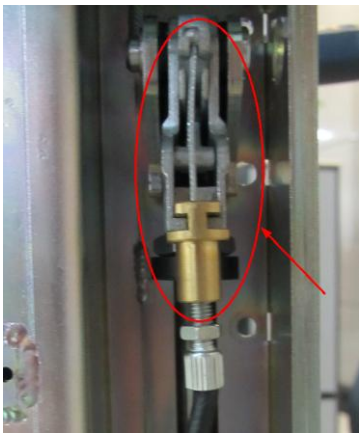
8.3.8 Lower Cover Assembly of Trolley's Handle

The disassembly tool: cross-headed screwdriver (M3, M4), inner hex wrench (M5), diagonal cutting plier.

1. Remove the upper cover of the trolley's handle and back cover of the stand. See *chapter 8.3.6* and *chapter 8.3.9*.
2. Unscrew 1 M4 X 12 screw with cross-headed screwdriver (M3, M4).



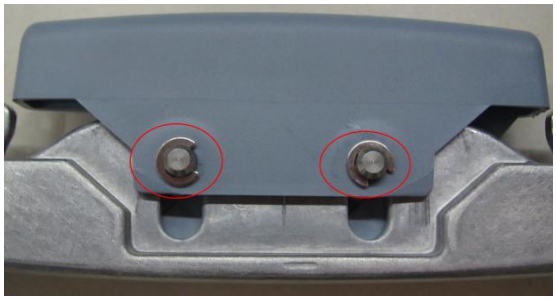
3. Pry one end of the bracing cable out with the cross-headed screw.



4. Unscrew 6 M5 X 12 socket head cap screws with Allen wrench (M5) to remove the lower cover assembly of trolley's handle.

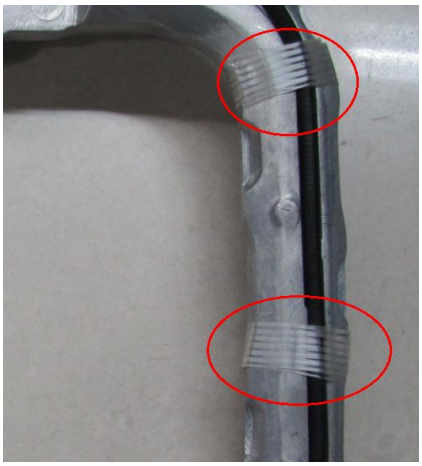
5. Unscrew 4 M3 X 8 combination screws with cross-headed screwdriver (M3, M4) to remove the lower cover of trolley's handle.

6. Remove 2 Φ 4 washers with diagonal cutting pliers to take out the height lever on the trolley.



7. Unscrew 1 M4 X 12 screw with cross-headed screwdriver (M3, M4).

8. Cut off the tie and remove the bracing cable.



8.3.9 Upper Cover of the Base

The disassembly tool: cross-headed screwdriver (M3, M4).

1. Put the cross-headed screwdriver to the gap between the upper cover of the base and the caster. Pry the upper cover up gently. Pry the upper cover of each caster out successively.

NOTE	In case of damage to the cover or the caster, do not remove by force.

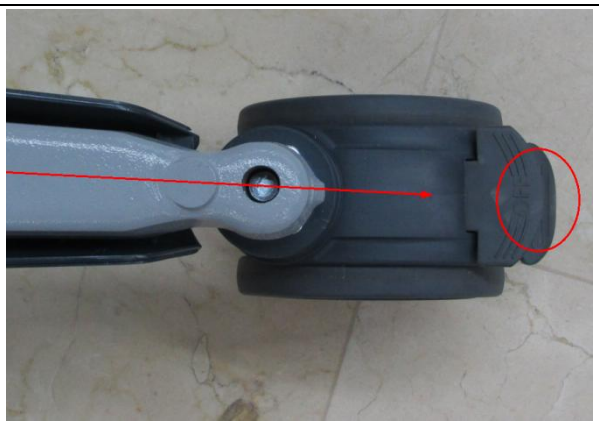
2. Remove the upper cover of the base towards arrow's direction.

8.3.10 Cable Reel Assembly

The disassembly tool: cross-headed screwdriver (M3, M4).

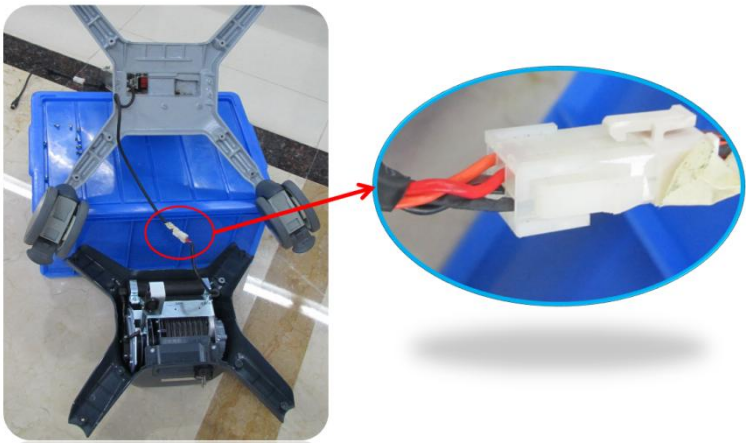
1. Keep each bar of the cast-iron base and the caster on line, and step on the Off brake to lock the caster.

NOTE	To avoid the cuts on the caster, disassemble the caster with the screwdriver wrapped with the cloth or other protections. If it is difficult to disassemble the caster, pry the upper covers of other bases first, and shake the upper cover gently on the level position. Then, pry out other upper covers difficult to loosen.



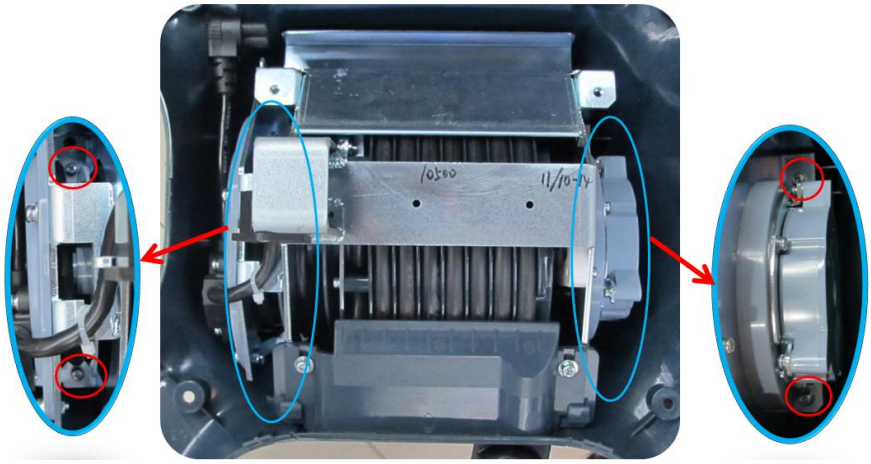
2. Put the trolley upside down. Unscrew 8 M4 X 12 combination screws to remove the cable reel assembly.

3. Pull the white plug, and remove the cable reel assembly.



4. Unscrew 2 M4 X 12 combination screws to remove the adapter.

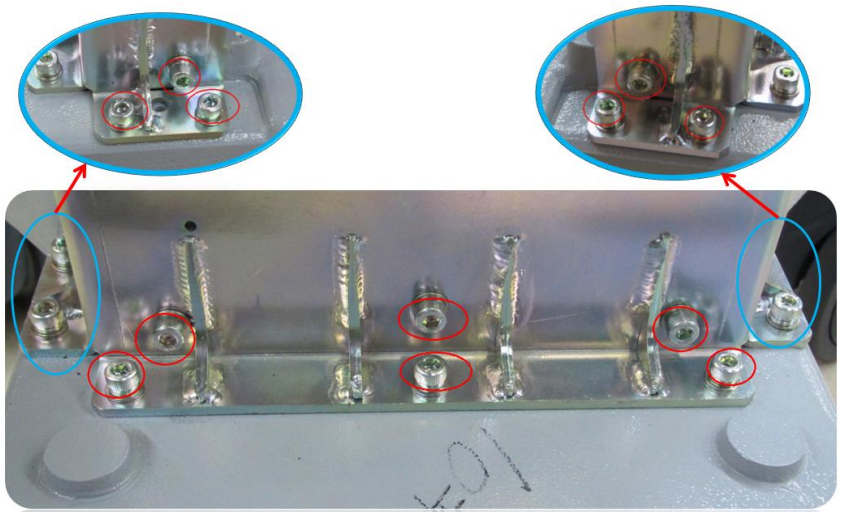
5. Unscrew 4 M4 X 12 combination screws to remove the cable reel.



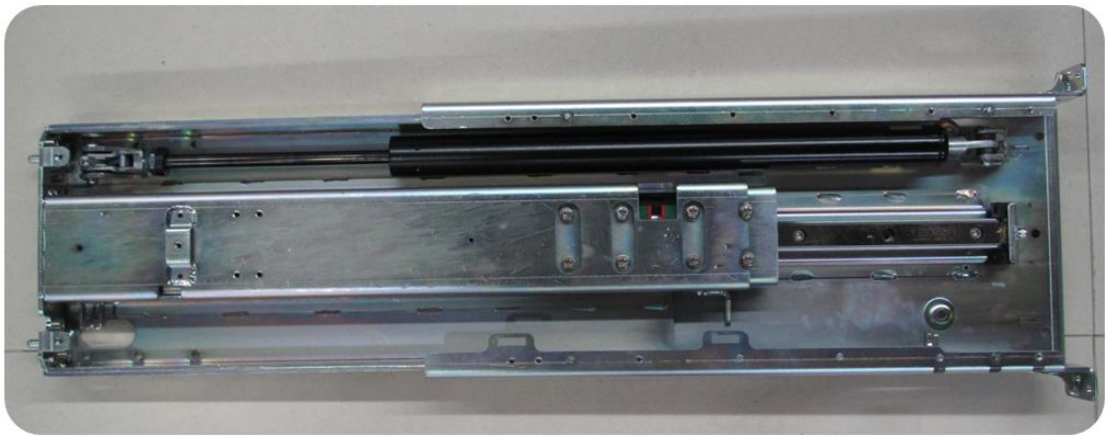
8.3.11 Stand Assembly

The disassembly tool: inner hex wrench (M5), cross-headed screwdriver (M3, M4), and diagonal cutting pliers.

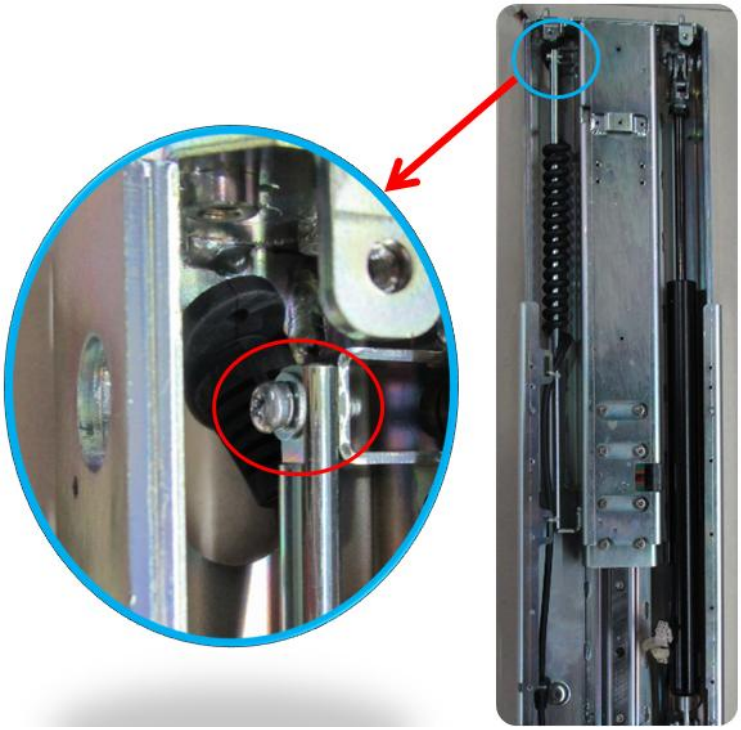
1. Remove the front/back cover of the stand and the upper cover of the base. See *chapter 8.3.9* and *chapter 8.3.11*.
2. Unscrew 12 M5 X 12 screws with inner hex wrench (M5) to remove the stand assembly.



3. Take out the stand assembly.



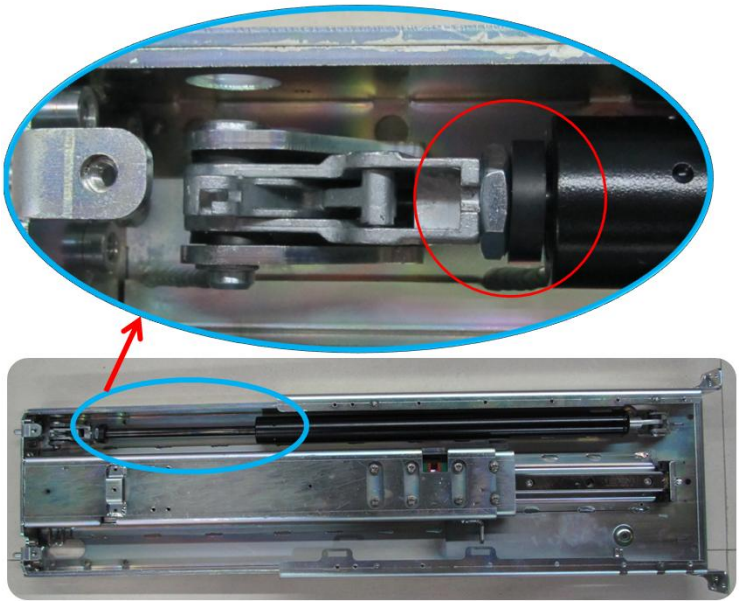
4. Unscrew 1 M3 X 8 combination screw with cross-headed screwdriver (M3, M4) to remove the steel guide rod of the spring.



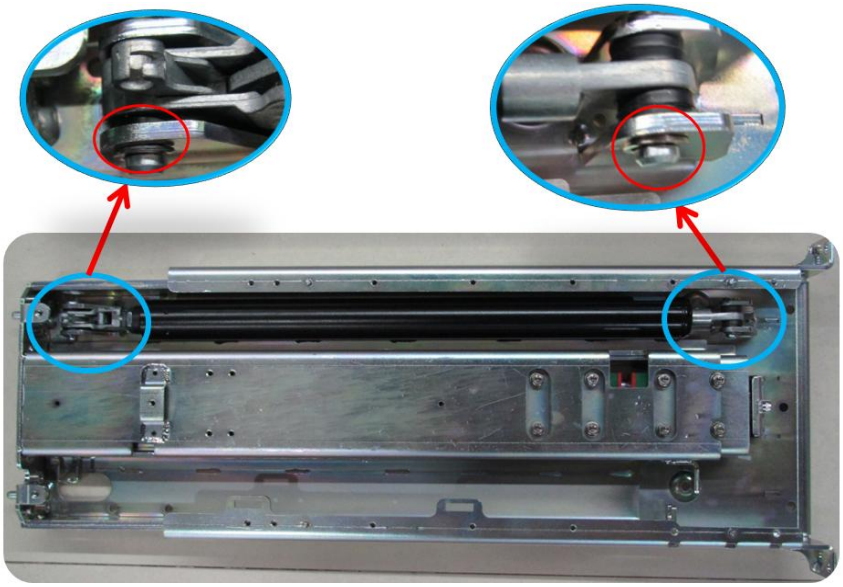
5. Pry the strain relief of the spring cable out with cross-headed screwdriver.

6. Cut off the cable tie with diagonal cutting pliers to remove the spring cable.

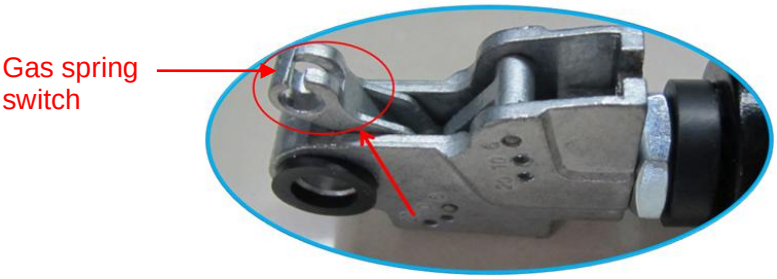
7. Set the gas spring to the lowest position.



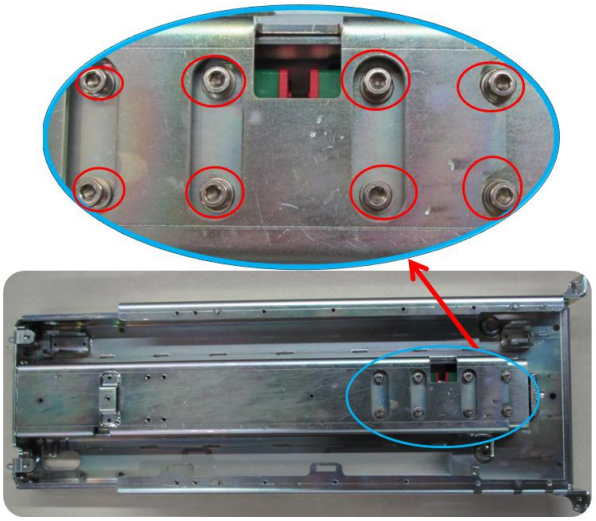
8. Remove 2 Φ 6 washers to take out the gas spring.



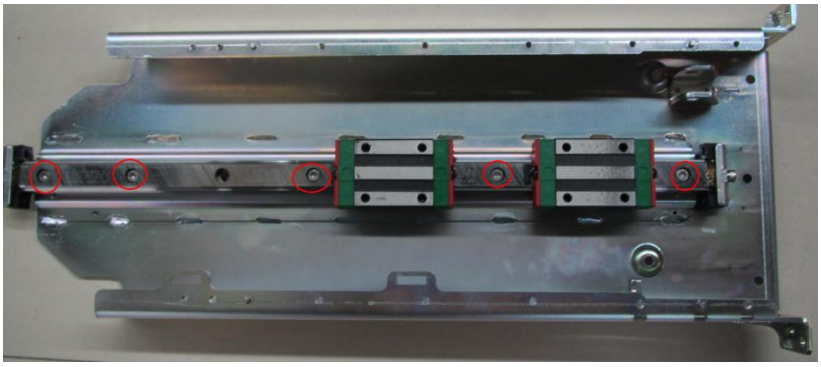
Note:	In case of the injury to humans as the gas spring ejecting the bar, do not trigger the gas spring switch when disassembling it as shown below.



9. Unscrew 8 M5 X 10 screws to remove the upper stand.



10. Unscrew 5 M5 X 20 screws to remove the guideway.



8.3.12 Caster

The disassembly tool: open-ended spanner.

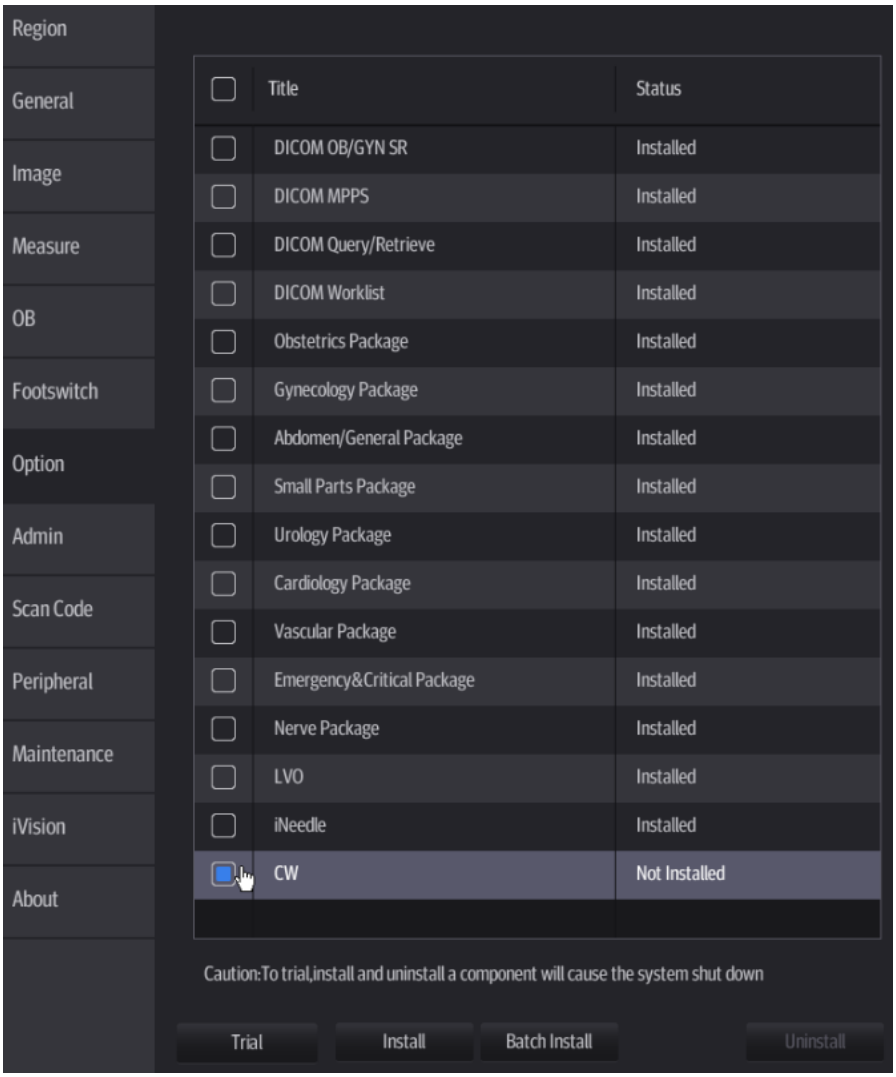
1. Step on each Off brake to lock the caster. (4 casters)

2. Seize the stud with the open-ended spanner, loosen the stud clockwise to remove the caster (4 casters).

9 Installation of Option Modules

9.1 Installation of Optional Devices to Software

1. Copy optional key file to USB flash disk and plug USB flash disk to the port.
2. Open “Preset” menu. Click [Maintenance]-[Optional]. Select the software package to be installed from the list.



3. Click [Install]. Select key file from the dialog box, and then click [OK].
   Click [Batch Install]. Select whole key folder from the dialog box, and then click [OK].

4. The optional assembly becomes “Installed” after the key files is installed. The corresponding function is activated after restarting the system.
5. Option trial: select the corresponding software package, and then lick [Trial].

Note:	After all modules are installed, please go to the previous interface to confirm.

◆ Uninstall

1. Select the software package to be uninstalled from option list.
2. Click [Uninstall] and it pops up the [Confirm] dialogue box. Click [OK];
3. Return to the system preset interface. The optional devices status changes into "installed".

Note:	The removal function is exclusive to internal users. The service engineers must log in the system with the account of “Service”, and then perform the installation.

9.2 Installation of the Accessory Kits and Optional Devices to Hardware

Hardware configuration list the system supports is displayed as shown below:

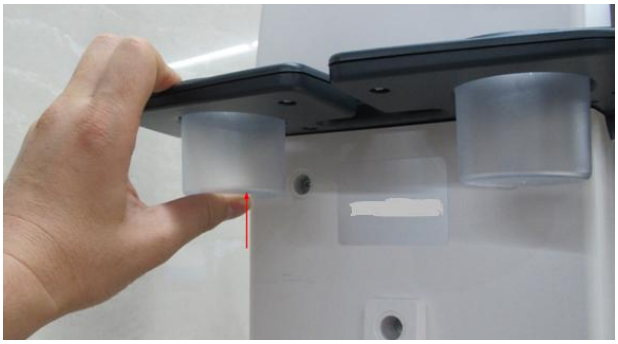
No.	Material No.	Descriptions	Material and pictures	Installation Reference
1.	115-020354-00	Desktop Mount	/	See chapter 9.2.4
2.	115-023076-00	Wall Mount	/	Refer to Wall Mount Operator's Manual
3.	043-003940-00	Small Probe Holder		See chapter 9.2.3
4.	043-004917-00	Big Probe Holder		See chapter 9.2.3
5.	043-006066-00	Storage Tray		See chapter 9.2.1
6.	043-003908-00	Probe Holder to the Trolley		See chapter 9.2.2
7.	115-035324-00	VESA connecting rod material package	/	See chapter 9.2.5 小节

9.2.1 Storage Tray

Tap to remove the storage tray towards the arrow's direction.

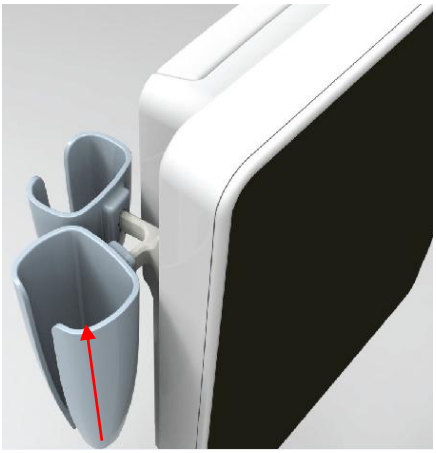
9.2.2 Probe Holder to the Trolley

Push the probe holder out towards the arrow's direction.



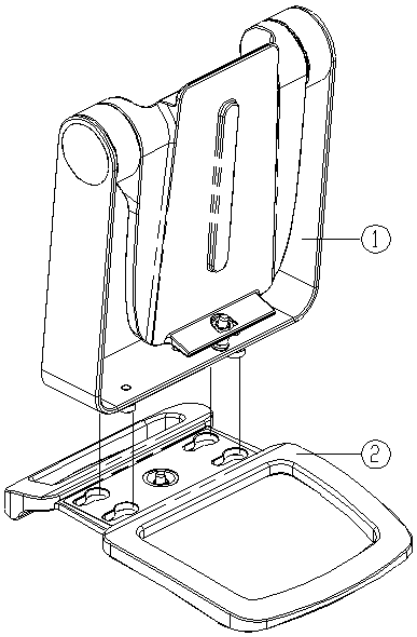
9.2.3 Probe Holder

Remove the probe holder upwards.



9.2.4 Desktop

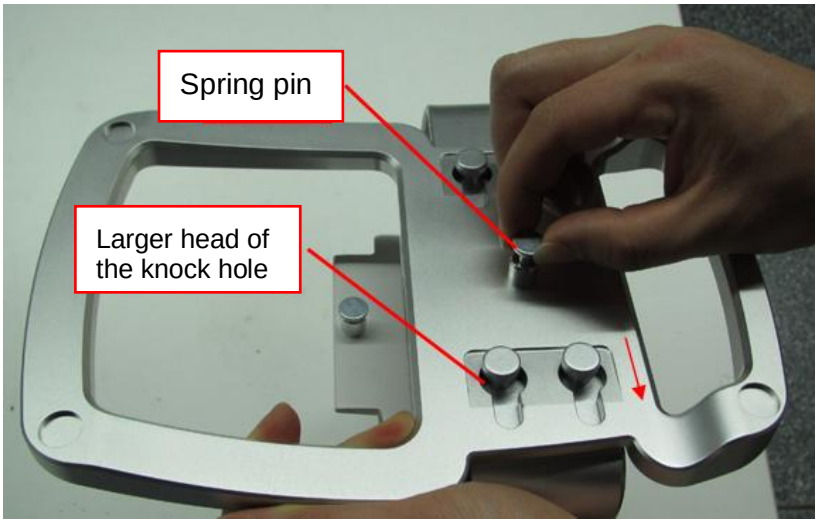
- Desktop appearance



No.	Name	Function
1	Main unit support	Used for fixing the main unit of ultrasound system.
2	Base of the desktop	Used for fixing the main unit support.

■ Assembly/Disassembly

1. Pull up the spring pin, and separate the spring pin from the knock hole of the base.
2. Push the base towards arrow's direction. Move each pin to the larger head of the knock hole. The base becomes separated from the desktop.



9.2.5 VESA Connecting Rod

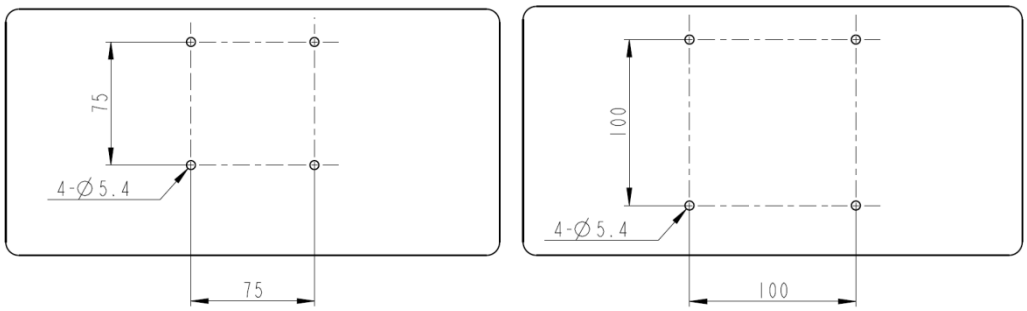
Parts of the VESA connecting rod (for reference)

Serial No.	Description	Qty.

1	VESA connecting block	1
2	Stainless steel Philips sunk head screw GB/T819.2-1997 M5X25	4
3	Standard spring washer GB/T93-1987 5, plated with environment-friendly colored zinc	4
4	Flat washer-class A GB/T97.1-2002 5, plated with environment-friendly colored zinc	4
5	Stainless hexagon screw GB/T6170-2000 M5	4

Mount the VESA Connecting Rod on Metal Bracket

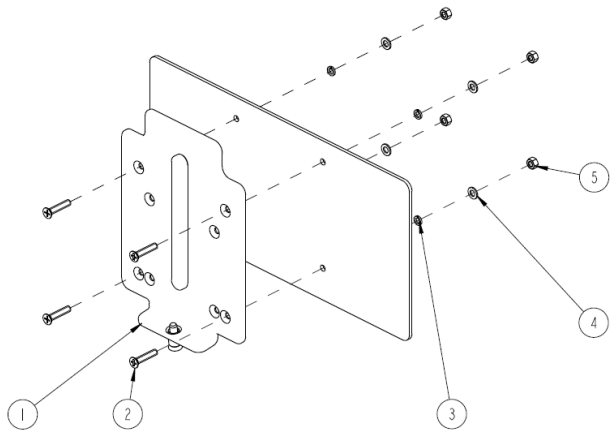
1. Drill through-holes on the metal bracket Φ 5.4mm (4 pcs). The hole may be one of the following size: 75x75mm or 100x100mm.



75x75mm 100x100mm

NOTE: Since the metal bracket may vary among the hospital, please drill the through-holes as upper as possible on the metal bracket; otherwise the probe on the rear side of the main unit may interfere with the metal.

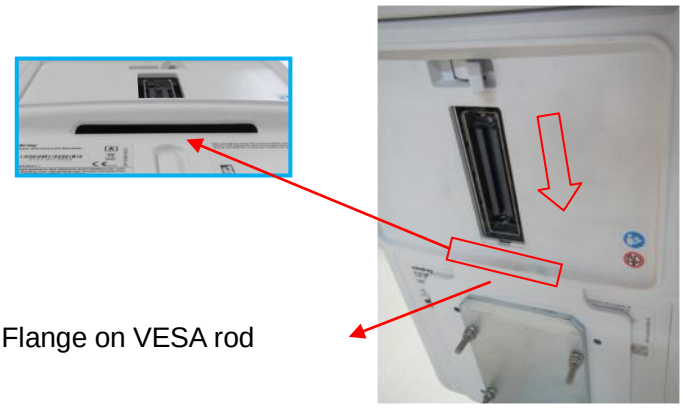
2. Align the through-holes on VESA rod with the through-holes (4 pcs) on the metal bracket, then fix the VESA rod on the metal bracket with M5x25 screws (4 pcs), sprint washer (4 pcs), flat washer (4 pcs) and hexagon head screws (4 pcs). The tightening torque of the cross-headed screwdriver is 18-22 kgf.cm, as shown in figure below.



Mounting Main Unit

⚠WARNING:	**The VESA connecting rod must be fastened before mounting the main unit.**

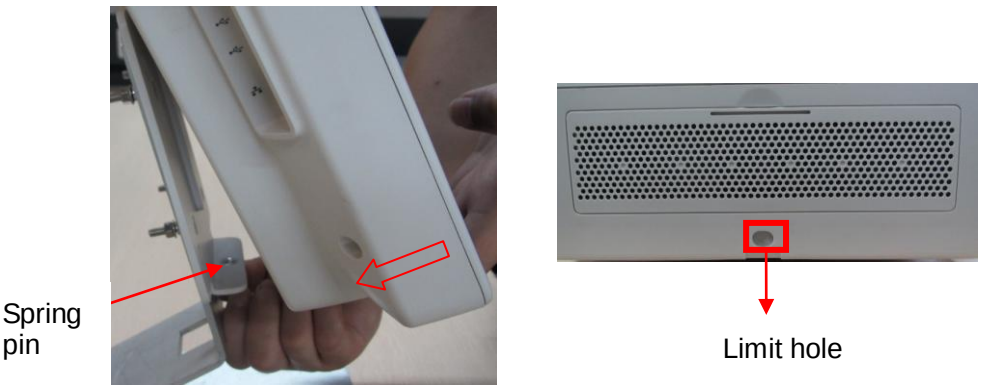
1. Follow the direction of the arrow on picture below to snap the flange of the VESA rod into the mounting slot on the main unit.



2. Push the main unit towards arrow's direction gently until the spring pin accesses the limit hole.

Note: if the spring pin is not fastened in the limit hole, pull down the spring pin, and then push the display gently.

After the installation is completed, push the display opposite to see whether the display is tightened.



10 System Diagnosis and Support

10.1 General Status Indicator

10.1.1 Display Status Indicator

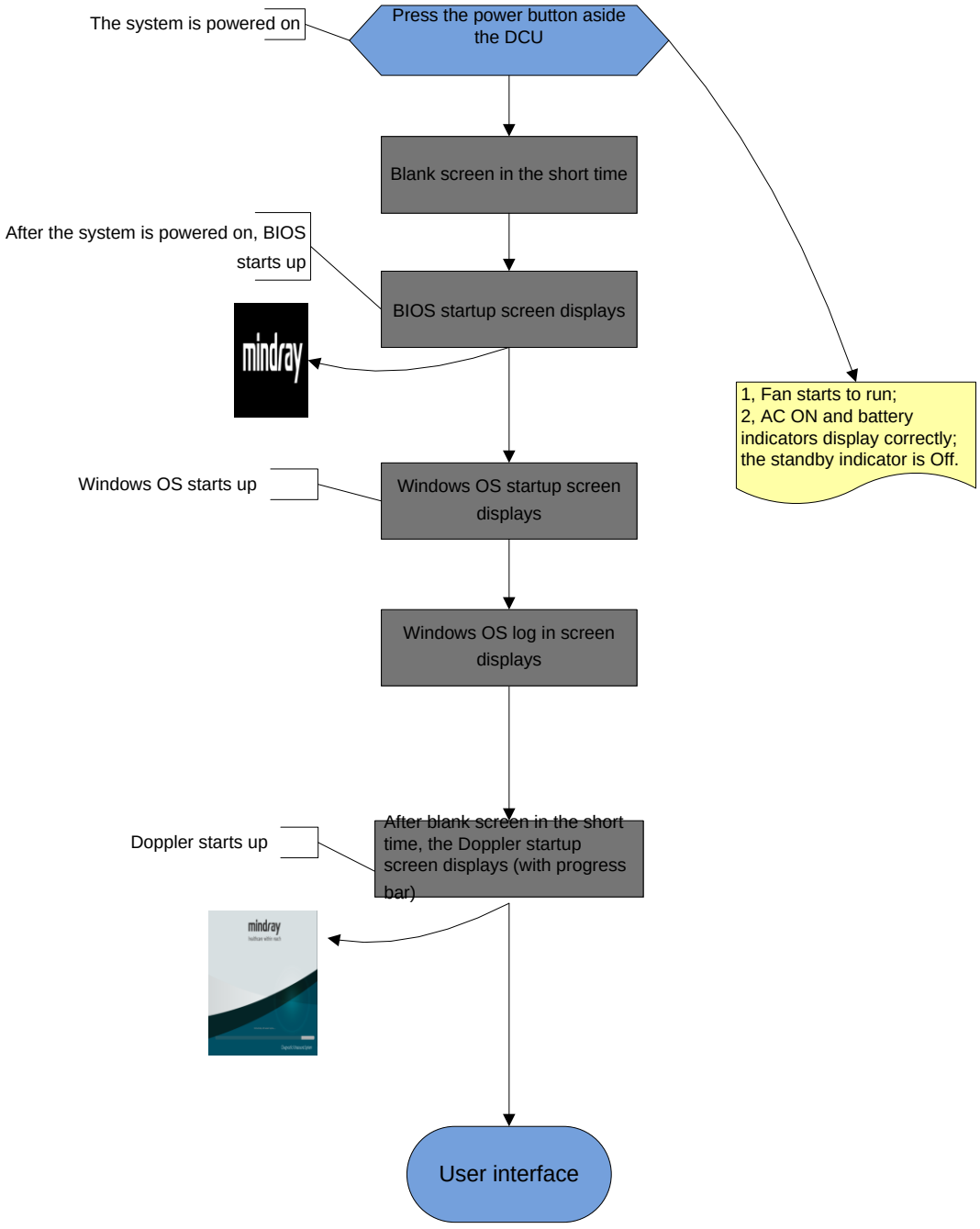
Status indicators	Icon	Status definition and indicators
Battery status indicator		1 It illuminates in orange color when batteries are charging; 2 It illuminates in green color when batteries are charged to full capacity; 3 The battery discharges with more than 20% electricity, and the indicator is green. 4 The battery discharges with less than 20% electricity, and the indicator blinks orange. 5 The battery discharges with less than 5% electricity, and the indicator blinks orange quickly. 6 When the battery is in non-charge/discharge status, the indicator is not on.
AC indicator		The indicator is green at AC supply. The indicator is off when batteries supplied.
Standby status indicator		The standby indicator blinks orange. Other status: light off

10.1.2 Status of Whole Machine

Status of whole machine	Status definition and indicators	To enter the Patient Info interface	To exit the Patient Info interface
Scan status	In power status, the indicator is green; in Freeze status, the indicator is white or off.	Enter or exit the scan status via [Freeze] key	
Frozen status	In power status, the indicator is green; in Freeze status, the indicator is orange.	Enter or exit the frozen status via [Freeze] key	

Standby status	The standby indicator blinks orange.	1 short press the power button, then, the system enters into the standby status by choosing from the status popped on the screen. 2 If there is no operation for a period of time, the system would enter into the standby status automatically.	The system restores to the frozen status after restarting by pressing the power button for a short time.
Screen-saver status	The brightness of the monitor keeps the same; The logo “mindray” moves around the screen. the indicator of the control panel is off. The system is frozen. Ultrasound imaging hardware system is in the dormancy mode.	There is no operation for the time set firstly, and then the system would enter into the screen-saver status from the frozen status automatically.	When you press any keys on the control panel, the system would return to the frozen status, the brightness restore to the previous status.
Power-off status	The system is on the power-off status (AC power is plugged in), and only the AC indicator is on. See battery indicator's description for battery indicator status.	Press the power button for a short time, and then the system is turned off by choosing from the status popped on the screen	Start the system by pressing the power button for a short time

10.2 Get Whole Machine Started


The system is powered on
Press the power button aside the DCU
Blank screen in the short time
After the system is powered on, BIOS starts up
BIOS startup screen displays
mindray
1, Fan starts to run;
2, AC ON and battery indicators display correctly;
the standby indicator is Off.
Windows OS starts up
Windows OS startup screen displays
Windows OS log in screen displays
Doppler starts up
After blank screen in the short time, the Doppler startup screen displays (with progress bar)
mindray
User interface

10.2.1 Power-on Process of Whole Machine Supplied by AC

Basic operations	Phenomenon
Plug the power supply cord into the mains power	AC power indicator on the main unit panel is ON; battery indicator is ON (if battery does exist); hard disk indicator and standby indicator are OFF.
Press power button on the side of the mian unit	/
The power has been power on	The fan starts to run.
After the initialization of hard disk and logic configuration are completed, PC enters into BIOS stage.	The monitor appears in blank screen for about 1 second.

10.2.2 The Start-up Process of BIOS

Basic Procedures	Basic phenomenon
Self-test after the system power-on	The LCD is blank screen and the speed is fast during the stage.
Start initialization process & record system settings & provide the resident program library.	BIOS start-up display
Loading the operation system	Display BIOS interface when loading. After completing the loading, the black screen appears. Then, WINDOWS interface appears.

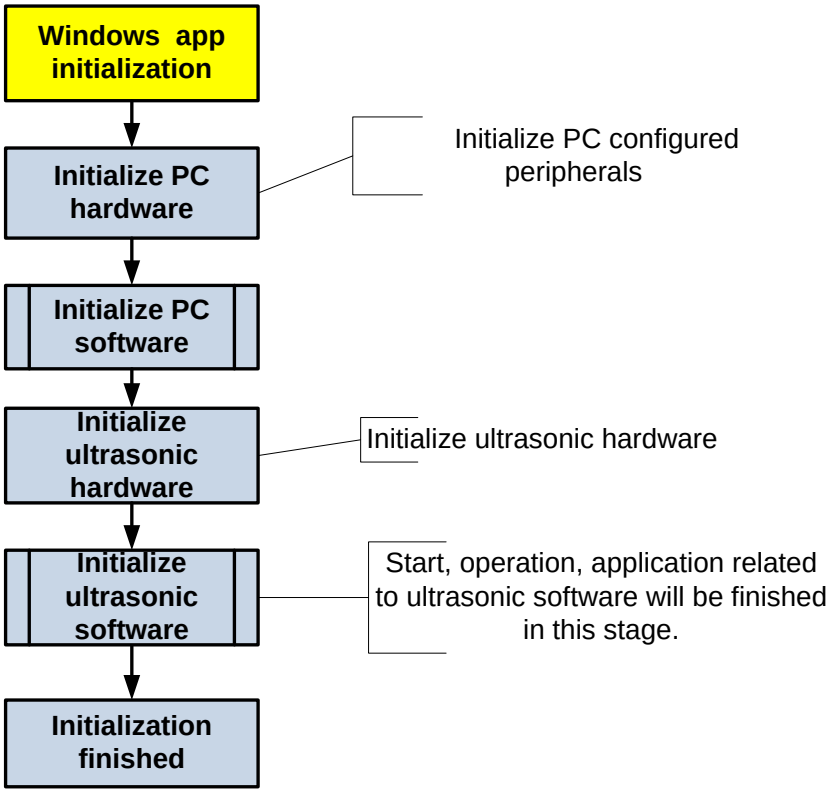
10.2.3 Windows Start-up

Basic Procedures	Basic phenomenon
Guiding the course of program loading	The LCD is black screen now, and the time of the course is short.
The course of testing and HDD configuration	The LCD is black screen now, and the time of the course is short.

The course of the internal core loading	The logo “mindray” appears.
The course of logging on	Same as the above
Starting DOPPLER	The company logo appears, and simultaneously progress bar shows the related information.

10.2.4 The Start-up of Doppler

10.2.4.1 Procedure of Startup


Windows app initialization
Initialize PC hardware
Initialize PC configured peripherals
Initialize PC software
Initialize ultrasonic hardware
Initialize ultrasonic hardware
Initialize ultrasonic software
Start, operation, application related to ultrasonic software will be finished in this stage.
Initialization finished

10.2.4.2 Details of Procedures

Step	Procedures	Increment	Description	Starting stagnation reason
No tips	Window start-up. appmon starts Doppler. Attach the path to configuration files. Set Windows attributes. Initialize display device, main interface, vocal, USB device representative. Start bus device Backbone Dev and LPC. Initialize the time and multi-language functions. Initialize the external file system, network and drive. Enumerate peripheral ports. Configure timer; initialize soft interrupt; construct maintenance server; configure system static data. Configure system font. Load layout information. Initialize UI manager and UI icon library.	In increment of 7	Start-up configuration, XP system	
Initializing hardware..	Load boot-trap graphics; display progress bar; release the package of configuration data; maintain data server		Boot-trap bitmap	/
Loading system preset…	Generate the servicer of local setting and system setting	In increment of 1	Configure preset data	
Loading common exam preset…	Generate general data management of the exam mode	In increment of 1		
Loading exam preset	Generate measure preset, peripheral and network, KMP package of images and the preset server of the network storage	In increment of 4		

Step	Procedures	Increment	Description	Starting stagnation reason
Initializing locale	Set area information, language, font library, input method; create control factory; config GUI layer; set menu item; initialize function library; create UICenter	In increment of 1	Configure hard disk data	/
Initializing gui	Construct the application layer Construct the user account control management, and remote desktop management	In increment of 1	/	/
Initializing ultrasound peripheral	Configure file dialog box; Initialize print library; Battery monitoring, PHV monitoring; Load print task icon; Configure low consumption; Configure USB manager and burn manager; Initialize video review device	In increment of 1	Configure peripherals, notify the battery	
Initializing ultrasound image	Create ECG receiving thread Set virtual machine; initialize virtual machine Create front-back object tree (ultrasys, etc)	In increment of 2	Pod data	
Initializing ultrasound application	Add function package of measurement menu; register application interface for the patient to be measured.	In increment of 1	Patient Info library	/
Initialization completed	Construct the patient information manager (UPatientApp)	In increment of 1		/
/	Enter Doppler interface	In increment of 1	Doppler interface	/

10.3 Alarming and Abnormal Information

The system is equipped with alarming function. When the machine fails, it pops up the alarming dialogue box, and simultaneously generates LOG file which is saved in the system log. The LOG file is saved under D disk: \TE7\Log.

NOTE:	The asterisk "***" represents the time in LOG record. The format is: 2014-6-12 14:15:15

10.3.1 Power Error

Alarming tips	LOG record	Suggestion
"Warning! Battery operation error! The battery may be damaged"	*** " left/ right Battery Hot insert "	Avoid hot-plug of the battery
"Battery communication error! Battery may not be used or battery capacity may not be displayed correctly"	*** "Left/Right Battery I2C error"	Battery error with AC power supply, check battery connection or replace the battery
"Battery communication error, Please connect AC power supply, or Power-off" " System will Power-off in 60s "	*** "Left/Right Battery I2C error, Battery supply"	Battery communication error, check battery connection or replace the battery
"Battery over-temperature, Please connect AC power supply, or Power-off" " System will Power-off in 60s "	*** " Left/Right Battery temperature is out of range temp，Battery temperature is: %f centigrade ， Battery Manufacture Access value: left: 0x%x, right: 0x%x "	Power with the adapter or power the system off to cool the battery.
"Battery error! Battery cannot be used!"	***" Left/Right Battery error." "Battery Manufacture Access value: left: 0x%x, right: 0x%x"	Left/right battery damage or protection; can be recognized by Manufacture Access value; if it's protection, shut down the system and wait for a while; if the battery is damaged, please replace it.
None	*** "Battery cycle is more than 300, Current cycle: left:??, right:??"	Battery aging, suggest replacing it according to the health status of the battery.

The battery status is displayed in “Preset”-“System Information”. See the table below.

Battery status	Condition	Description
“GOOD”	No damage to the battery or the protection recoverable. The fully charged battery capacity (FCC) is larger than 40% of rated voltage.	The battery status is good, and can be used normally.
“WEAK”	No damage to the battery or the protection recoverable. The fully charged battery capacity (FCC) is less than 40% of rated voltage. Cycling times of the battery< 300	Discharge or charge the battery fully. Restore some of the battery capacity.
“RELACED”	No damage to the battery or the protection recoverable. The fully charged battery capacity (FCC) is less than 40% of rated voltage. Cycling times of the battery > 300	Battery capacity goes down after long-time use. It affects the battery performance and endurance time. Replace the battery as necessary.
“INVALID”	Unrecoverable destructive protection of battery	Permanent damage to the battery. Remind the user of replacing the battery.
“PROTECTED”	Recoverable protection of the battery	The recoverable protection occurs to the battery. The battery recovers after a time period. Contact the service engineer for any questions.

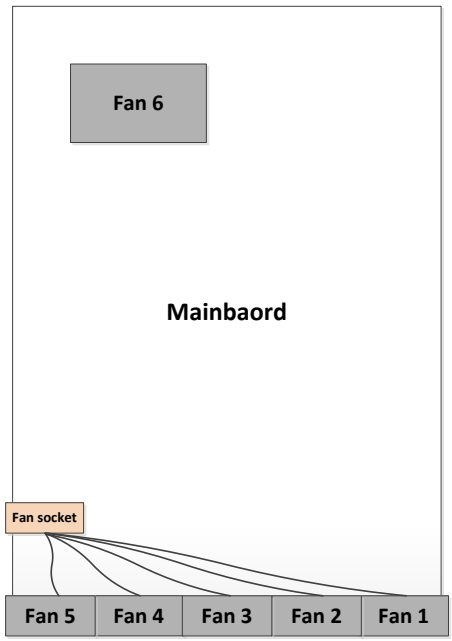
10.3.2 Abnormal Voltage of System Power

Alarming tips	LOG record	Suggestion
The real-time battery will be out of power, please replacing it.	*** System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]~[HHH]V	Replace button battery
N/A	*** System Monitor: Power supply alert! [XXX], Current voltage: [VVV] V, Limit voltage:[LLL]~[HHH]V [XXX] represents voltage name, [VVV] represents the current value, and [LLL]-[HHH] represents the upper and lower limits. The voltage names respectively are: P2V5、N11V7、P3V3、P5V、 P1V2、P1V8 、AP5V6、AP3V6、P12V、P1V5、 AP2V、AP2V8、P1V、P1V35	If a certain segment of the circuit is abnormal, or goes higher or lower, it should replace main board.

10.3.3 Abnormal Temperature

<table>
<tr><th>Alarming tips</th><th>LOG record</th><th>Suggestion</th></tr>
<tr>
<td>“Temperature Alert"
(After the alarm the software starts to shut down the system)</td>
<td>*** System Monitor: Temperature Alert! [XXX], Current temperature: [VVV] ℃, Limit temperature: [LLL]-[HHH] ℃。
[XXX] represents temperature name; [VVV] represents the current value, and [LLL]-[HHH] represents the upper and lower limits. The names for the temperature: .FPGA、CPU thermal sensor
<table>
<tr><th>Hot spot name</th><th>Temperature name</th></tr>
<tr><td>DSP FPGA</td><td>FPGA</td></tr>
<tr><td>PC module</td><td>CPU thermal sensor</td></tr>
</table>
</td>
<td>Restart the system after the device is shut down due to temperature alarm.
Check fan log D: \TE7\Log \TE7_Log.20XX-XX-XX.xml
(20xx-xx-xx means date of the log)
Check if the fan stops or check the cooling condition of the device.</td>
</tr>
</table>

10.3.4 Fan Error

<table>
<tr><th>Alarming tips</th><th>LOG record</th><th>Suggestion</th></tr>
<tr>
<td>“Ventilator requires maintenance, please contact the service!”</td>
<td>*** System Monitor: Fan alert！[XXX], Current speed : [VVV] rpm, Limit speed: [LLL] rpm
[XXX] represents fan name; [VVV] represents the current value; and [LLL] represents the gate limit.
Location of the fans are as shown in figure below (facing the front of main board and the rear side of the main unit, from up to down):
 

</td>
<td>Replace the fan/re-connect the circuit/clear off fan blocking.</td>
</tr>
</table>

10.3.5 PHV Error

Alarming tips	LOG record	Suggestion
Alarm! high-voltage transmission is abnormal, and images display normally!	*** HARDWARE_WAR(0xB1).PHV hardware protection, HV_PRN_N (+-100V)	Cut off the power supply after shutting down the device. Check the restoration of the system. Otherwise, it is necessary to replace front PHV power board.
	*** HARDWARE_WAR(0xB1).PHV hardware protection, PHV_OVP_N (OverVoltage Protection)	
	*** HARDWARE_WAR(0xB1).PHV hardware protection, PHV_OCP_N (OverCurrent Protection)	
	*** [CCC]([HH]).[XXX] supply voltage error. [XXX] volt is [PPP] V (upper limit is [LLL]V). [CCC] represents name of current alarm protocol, [HH] represents the protocol frame header. [XXX] represents the voltage name: PHV-1P, PHV-1N, PHV-2P, PHV-2N , CW-P, CW-N [PPP] represents absolute value of current voltage. [LLL] refers to upper limit of preset voltage.	Shut down and restart to check if the system is restored to normal. If not, shut down and cut the power supply (including battery). If the problem still exists, replace front power supply board.
	*** [CCC]([HH]).[XXX] supply voltage error. Current volt is [PPP] V, out of range 95V~105V. In which [CCC] refers to the frame name of current alarming protocol and [HH] refers to frame header. [XXX] refers to the name of high voltage, the range of which is from +100 V to -100 V. [PPP] refers to absolute value of current voltage.	
	*** PHVCURRENT_WAR（0xB2）.Channel [XXX] supply current error. Channel [XXX] current is [PPP]mA. [XXX] represents the channel number of voltage: 0-3 [PPP] represents the current value of current voltage channel.	
	*** [CCC]([HH]).PHV volt abnormal protection. **{**PHV-1P volt:[PPP]V, PHV-1N volt: [PPP]V,**}** PHV-2P volt: [PPP]V, PHV-2N volt: [PPP]V. [CCC] represents name of current alarm protocol, [HH] represents the protocol frame header. [PPP] represents absolute value of current voltage. {..} represents when the PHV-1P and PHV-1N voltage is not used (e.g. in CW mode). It can be omitted.	Cut off the power supply after shutting down the device. Check the restoration of the system. Otherwise, it is necessary to replace PHV power board.
	*** [CCC]([HH]).CW volt abnormal protection. CW-P volt: [PPP]V, CW-N volt: [PPP]V. [CCC] represents name of current alarm protocol, [HH] represents the protocol frame header. [PPP] represents absolute value of current voltage.	

10.3.6 Other Errors

Alarming tips	LOG record	Suggestion
Fail to open the file "SystemConfiguration.ini", and please check HDD data!	N/A	Re-install the system software.

10.4 Self-test

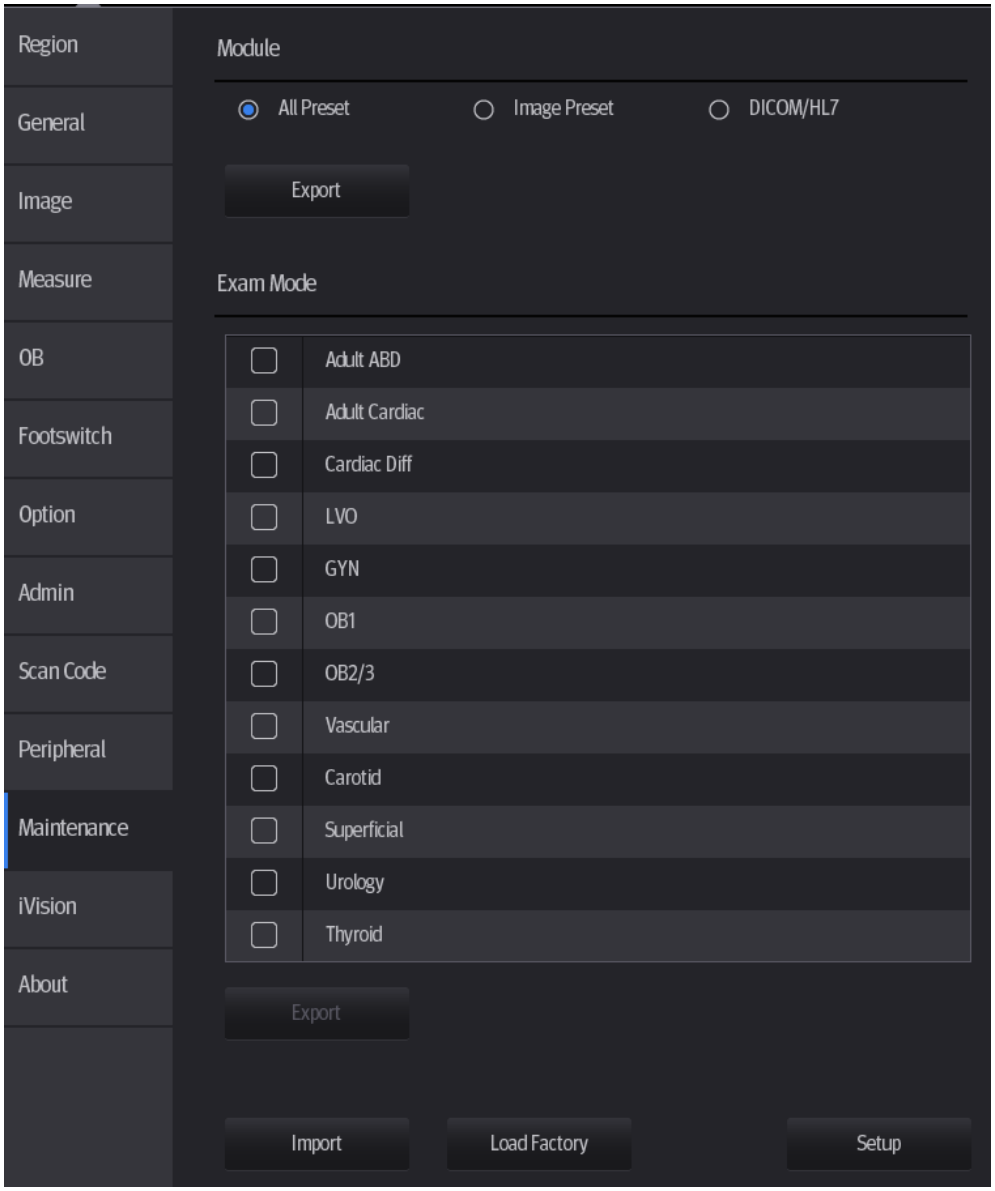
10.4.1 Self-test Introduction

The self-test function, adopted by TE7 series products, is used to test the connection of hardware board, running status of the device. According to the access authority and tests, there are three types of tests: production self-test, maintenance self-test and user self-test. This chapter describes the maintenance self-test and user self-test in details.

10.4.2 Operation Procedure of Maintenance Self-test

Note:	Before entering system self-test, all tasks running on Doppler should be completed, otherwise the self-test system fails to respond. It is recommended to start self-test software to perform the test after the system is generated.

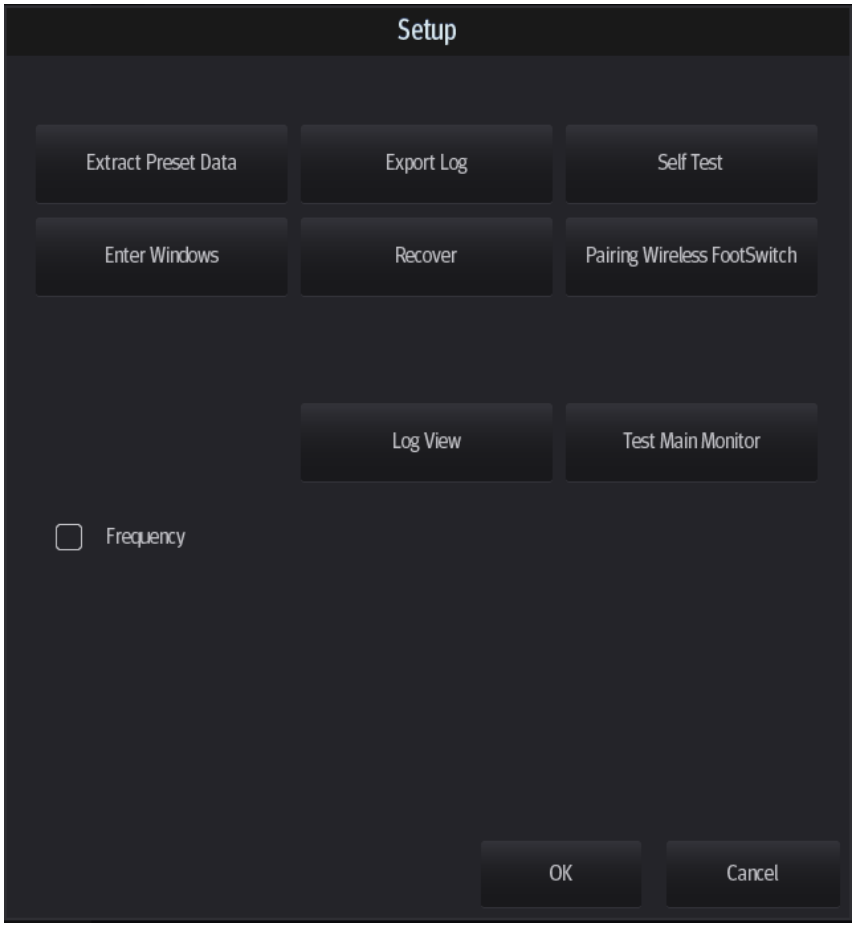
1. Switch account, type service password and service account to log in.
2. Tap in the top-right corner of the screen and select to enter the setup menu. Click [Maintenance] - [Setup].



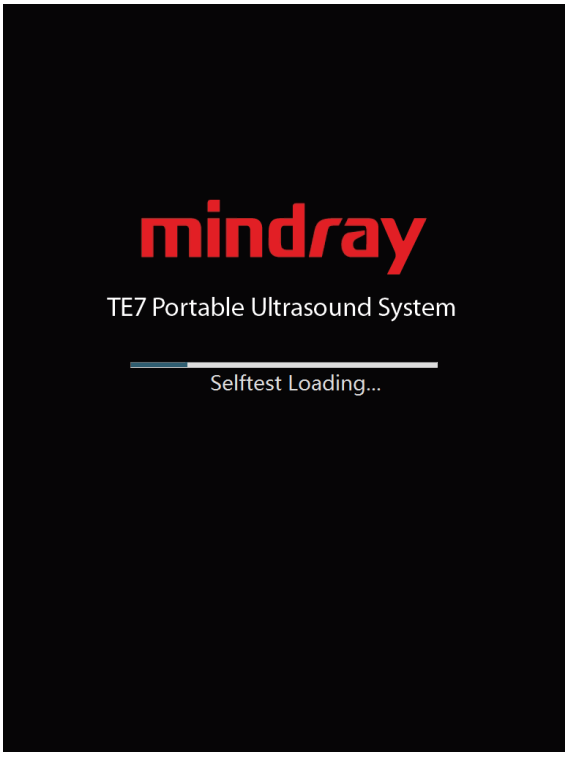
Click [Self Test] out of dialog box.

Note: If the system is in Chinese, the self-test performs Chinese system self-test.

If the system is not in Chinese, the self-test performs English system self-test.



3. The booting screen of system self-test appears.



Booting screen of system self-test

4. Configure corresponding preset items on maintenance self-test interface. After finishing the configuration, click [Start] to perform self-test. See the table below:

Button Name	Description
[Open All]	Click to unfold all items that are folded.
[Close All]	Click to fold all items that are unfolded.
[Default]	The system performs item tests by clicking it.
[Select All]	Select all test items by clicking it.
[Select None]	Cancel the test item by clicking it.
[Continue/Stop]	One button for two operations [Continue] and [Stop]. If you click [Continue], the test continues even though a test item fails during the test; however if you click [Stop], the test stops once a test item fails during the test.
[Start]	Click to perform tests for checked items one by one while the button turns to [Stop]. During the test, if you click [Stop], the test stops. After the test is completed, the [Stop] button turns to [Start], and waits for the next test.
[Next Fail]	After completing the test, click [Next Fail]. The program searches for the failed test item from message list, and rearrange it to the top of the test information list. If the program reaches the bottom, it starts to search from the top of the list again.
[Clear History]	Click to clear off the test data in *Testitems* and *Messages* and to initialize the system structure diagram to original status.
[Loops]	It is used to perform loop test. Select the check box and type the times for loop test in the box on the right of screen, and perform the test according to the times typed. If the loop times are less than 0, it continues the loop test before the user stops it or encounters the error.
[Save Report]	The dialog box to remind the user of exporting the report appears by clicking the button. Plug the removable storage device, and select corresponding logic drive, and then click [OK]. The test data is saved to the selected root directory. The button is disabled if the removable storage device is not plugged in.
[Shut Down]	Close the program, and shut down the device. The system reminds the user of saving the test report to removable storage device when shutting down the device.
Remarks: the test item includes parent-test item according to the board from the test area. There are sub-test items belonging to parent test item. It can be customized according to the requirement. If the test item is ticked (☑), this item is in the test list; otherwise, this item is not in the test list. When a parent item is selected, all the sub items of this item are selected by default; otherwise, when deselecting a parent item, all the sub items of this item are deselected by default.	

Description:

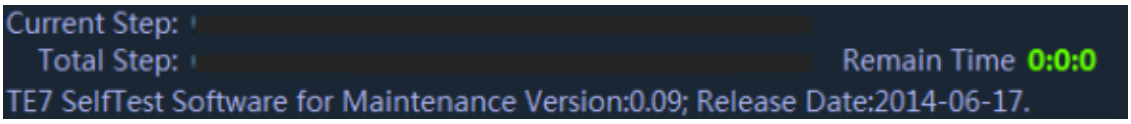
The user can see production, maintenance and user self-test interface from the screen. The production and maintenance self-test interfaces can be divided into five areas.

Maintenance self-test interface

5. Self-test status display:

   When the program is running, the version and release date, *TE7 SelfTest Software for Maintenance Version：xx； Release Date：YYYY-MM-DD*, will be displayed on the left side of the status bar. During the test, the software version in the status bar becomes the name of current test. The current test progress and overall test progress are displayed on the status bar.

   Beyond that, the status bar tests the rest time in real-time.



Sketch of test status bar

6. Monitoring information bar

Current time, CPU ocCPUation rate, CPU 1 temperature, CPU 2 temperature, CPU 3 temperature, CPU 4 temperature, DC-DC temperature, AFE temperature and DSP FPGA junction temperature display on monitoring information bar.

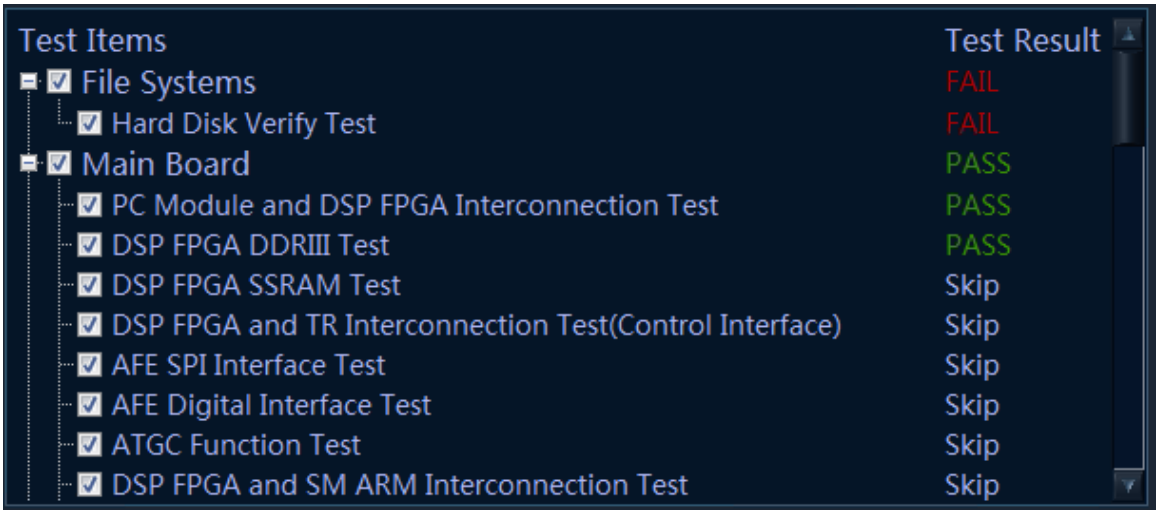
If the temperature exceeds the working temperature, the temperature status in progress bar appears in red.

7. System dialog box

   The element in the system dialog box changes as the color of test result changes in the test process. If the test fails, the color of the element becomes red; if the test succeeds, it becomes green. If the color of the element does not change, it indicates the test does not proceed.

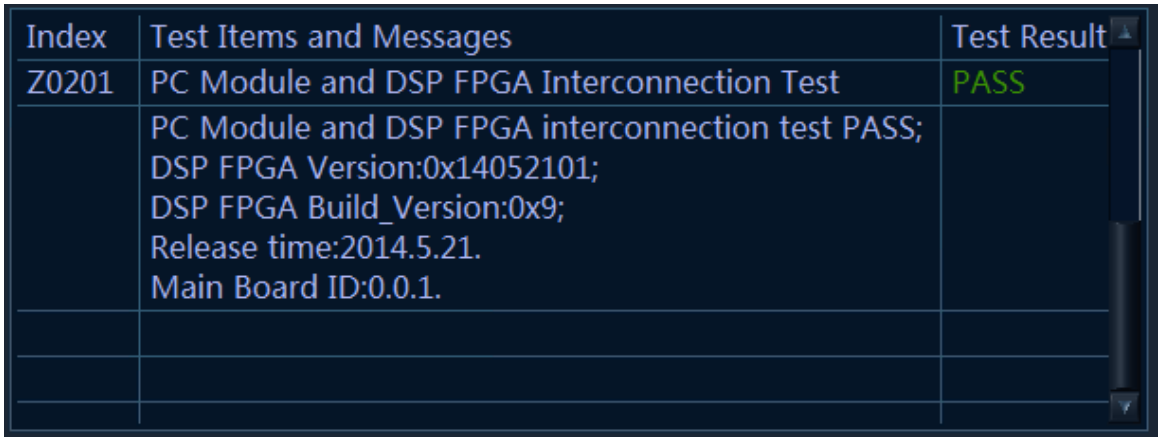
8. Test information

   The test result is displayed after the test is completed. Green *PASS* indicates the pass of the sub-item. Red *FAIL* indicates the failure of the sub-item. If the item has not been tested, it appears in grey *Skip.* If the board and the assembly are absent, it appears in grey *NaN*. Red *Error* appears as the test item error occurs. The test result of parent test item is the aggregate for the test result of all selected sub-test items. If there is *FAIL* test in the selected list, the test result of parent test item is *FAIL*. As long as the test result of the selected item is *PASS*, the test result of parent test item is *PASS*.As shown in the following figure.



Display of test result in Testitems table

Click each test item in *Testitems* list. The program search for corresponding test result of test item and displays it in details, as shown below.

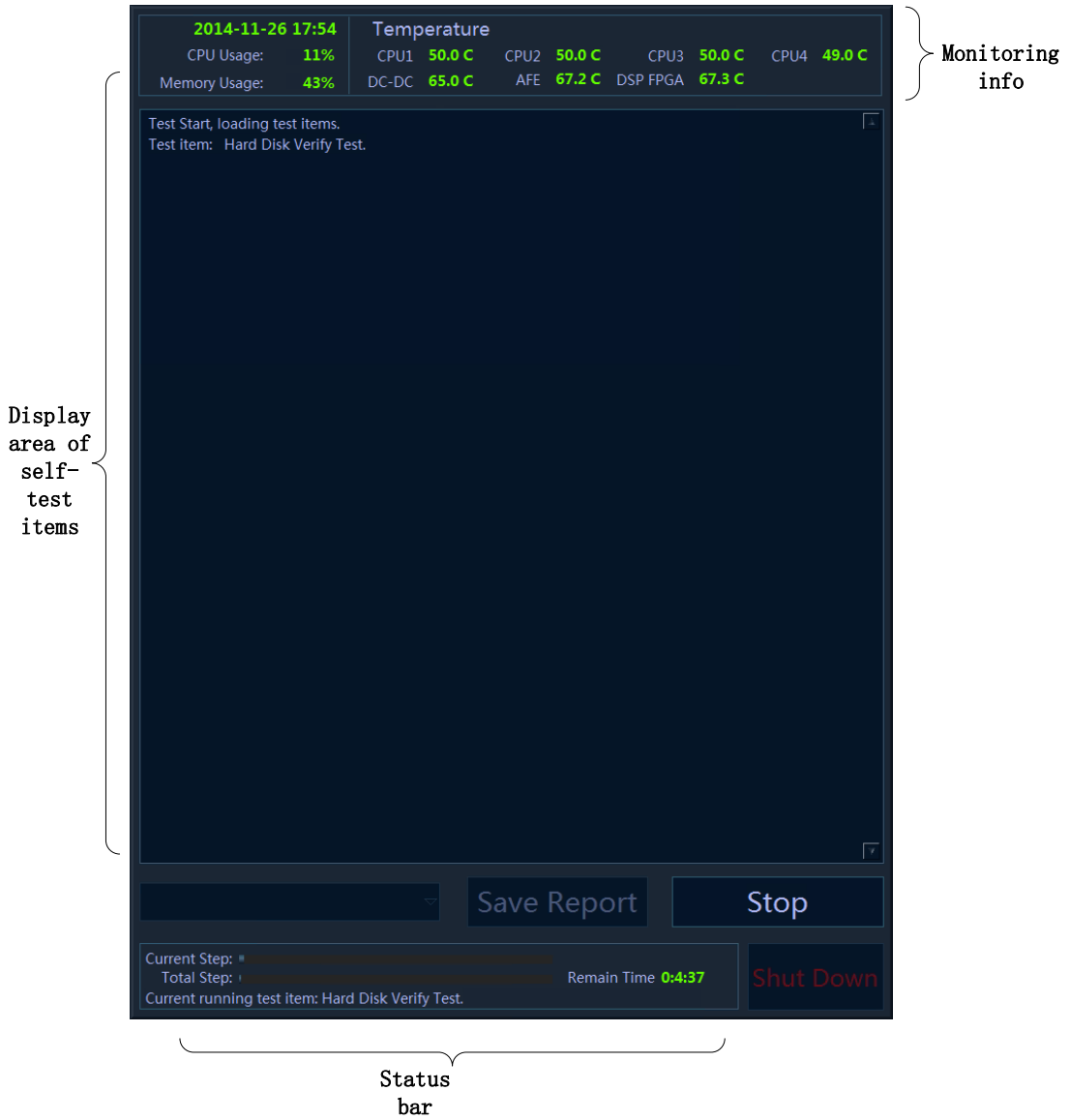


Display of test result in Messages table

The number to the test item appears in front of the name of test item. The number format is: ZXXYY and all test items are started with "Z". XX represents sequence number of the first level for item test and YY represents the second level. For example: the number of *System Voltage Test* is *Z0210*, in which *02* is the second test item of the first level directory in *Main Board,* and *10* is the tenth test item of *System Voltage Test* in *Main board*.

10.4.3 User Self-test

Start the device. Tap in the top-right corner of the screen and select [Setup] to enter the setup menu. Tap [Maintenance]-[Setup]-[Self Test] to perform the operation.



User self-test interface

There are three divisions in user self-test interface: display area of self-test item, monitoring information bar and status bar. The functions on monitoring information bar are same with those on user self-test interface. The self-test area only displays the item that has been tested, but not the test result.

Item	Description
[Start/Stop] button	Click to perform tests for checked items one by one while the button turns to [Stop]. During the test, if you click [Stop], the test stops. After the test is completed, the [Stop] button turns to [Start], and waits for the next test.
[Test Report Save Location] Check box	Displays the logic drive of removable storage medium (USB flash disk, removable hard disk, etc) connecting to the system. The check box is disabled in test process. If there is no removable storage medium, click the control which reminds the user of inserting the removable storage medium.
[Save Report] button	Save the test data to the root directory of selected logic drive. The button is disabled when the logic drive is deselected or in test process.
[Shut Down] button	Close the program, and shut down the device. The system reminds the user of saving the test report to removable storage device when shutting down the device.

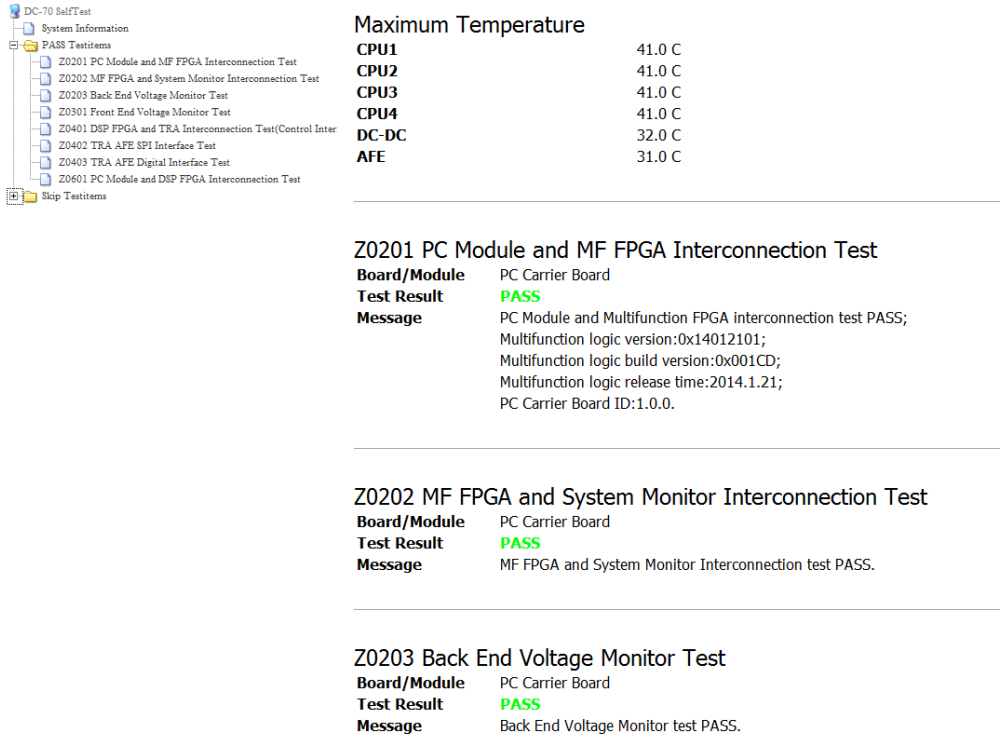
Start the test when entering user self-test. After finishing the test, the number of test item only displays on the screen if there is *FAIL* test item. For example, if *System Voltage Test* fails, only does Z0210 display on the screen. It is available for user to notice that Z0210 corresponds with test item *System Voltage Test* by viewing Appendix.

The dialog box of PASS appears only with all test items passing, as shown below:

10.4.4 Test Report

10.4.4.1 Test Report

The default format of test report is HTML. The test report can be browsed via Internet Explorer. The format is shown below:

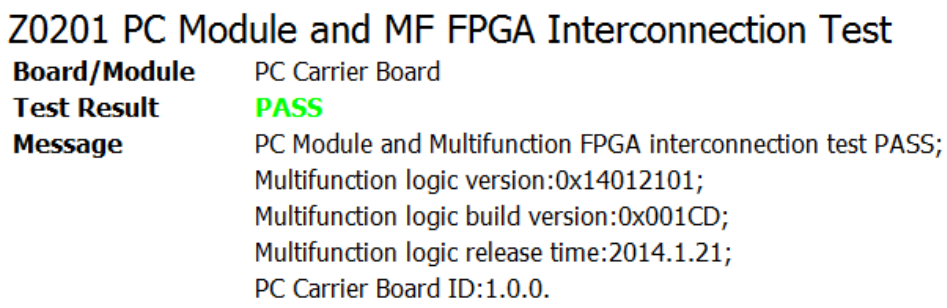

DC-70 SelfTest
System Information
PASS Testitems
Z0201 PC Module and MF FPGA Interconnection Test
Z0202 MF FPGA and System Monitor Interconnection Test
Z0203 Back End Voltage Monitor Test
Z0301 Front End Voltage Monitor Test
Z0401 DSP FPGA and TRA Interconnection Test(Control Inter
Z0402 TRA AFE SPI Interface Test
Z0403 TRA AFE Digital Interface Test
Z0601 PC Module and DSP FPGA Interconnection Test
Skip Testitems
Maximum Temperature
CPU1 41.0 C
CPU2 41.0 C
CPU3 41.0 C
CPU4 41.0 C
DC-DC 32.0 C
AFE 31.0 C
Z0201 PC Module and MF FPGA Interconnection Test
Board/Module PC Carrier Board
Test Result PASS
Message PC Module and Multifunction FPGA interconnection test PASS;
Multifunction logic version:0x14012101;
Multifunction logic build version:0x001CD;
Multifunction logic release time:2014.1.21;
PC Carrier Board ID:1.0.0.
Z0202 MF FPGA and System Monitor Interconnection Test
Board/Module PC Carrier Board
Test Result PASS
Message MF FPGA and System Monitor Interconnection test PASS.
Z0203 Back End Voltage Monitor Test
Board/Module PC Carrier Board
Test Result PASS
Message Back End Voltage Monitor test PASS.

The test item list lies on the left side of the report and is classified according to test results. Click the test item on the left side of the report. The test data of the item displays in the report.

The test information lies on the right side and includes:

1. Report name;
2. The time that report generates, and software version information;
3. Screenshot of system structure diagram;
4. System information;
5. Highest temperature;
6. Test item data of *FAIL* test (if there is no FAIL test item, the directory does not unfold);
7. Test item data of *PASS* test (if there is no *PASS* test item, the directory does not unfold);
8. Test item data of *Skip* test (if there is no *Skip* test item, the directory does not unfold).

Test data format of each test item is shown below:


Z0201 PC Module and MF FPGA Interconnection Test
Board/Module PC Carrier Board
Test Result PASS
Message PC Module and Multifunction FPGA interconnection test PASS;
Multifunction logic version:0x14012101;
Multifunction logic build version:0x001CD;
Multifunction logic release time:2014.1.21;
PC Carrier Board ID:1.0.0.

In which, [Z0201] refers to the index of test item;

[Board/Module] refers to the board and the module that test item lies in;

[Test Result] refers to the result of test item;

[Information] refers to the information of test item.

10.4.4.2 Test Data Storage

Take the time as the report name, and compress it into Zip file.

The test report is saved under the directory of *D:\M6\Log\SelftestReport.* 20 copies of test reports at most.

- Non-loop test

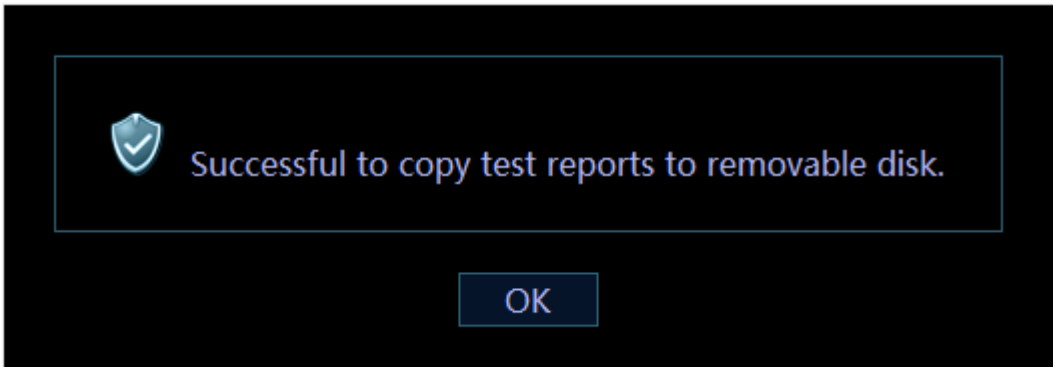
  The test result will be compressed into Zip file and saved under the directory of *D:\M6\Log\SelftestReport* to non-loop test. One Zip file owns one report.

- Loop test

  Click [Save Report] after finishing the test. The loop test is compressed into a Zip file package and saved under the directory of *D:\M6\Log\SelftestReport.* There are N reports in Zip file package where the reports are put into the folder of *Test Report Loop_N.* The test results are *PASS* and *FAIL*. N is the loop times of the test.

10.4.4.3 Test Data Export

1. Plug USB flash disk or removable storage medium to the port of the device.
2. The user chooses the logic drive of removable storage medium. Click [Save Report] on test interface to export the test data to root directory of the drive, and name it as *Test Report*. The dialog box appears after the test report is saved successfully.



3. See *Appendix C* for details of test items.

Note:	It is not operational for users if there is no removable storage medium to the computer.

11 Care and Maintenance

11.1 Overview

The maintenance procedure in this chapter is for recommendation.

11.1.1 Tools, Measurement Devices and Consumables

Table 11-1 List for Tools and Measurement Devices

Tools/Measurement Devices	Qty.	Remarks
Plastic and resin container	1	Used to contain the physiological saline and two probes available in the container.
Soft brush	1	The size is similar to that of the brush. The material of the brush should be soft.
Small plastic bowl	1	Used to contain soap-suds
Safety testing device	1	See *Appendix A* for details

Table 11-2 Consumable List

Consumable	Qty.	Remarks
Aluminum foil	About 1 meter long	
Physiological saline	About 1000 mL	Reach the half of the container to submerge the probe in the saline. (See *Appendix A* for details) (Concentration 0.85% to 0.95%)
Mild soap-suds	About 400 mL	
Dry soft cloth	5 pieces	

11.1.2 Routine Maintenance Items

Table 11-3 The list for maintenance items and maintenance frequency

No.	Item	Frequency	Method
1.	Dust-proof cover cleaning	1 time/month	See *Chapter 11.2.1*
2.	The monitor cleaning	1 time/month	Ditto
3.	Probe cleaning (head of the probe)	Every time after use	Ditto
4.	Probe cable and connector cover cleaning	1 time/month	Ditto
5.	Holder cleaning (including probe holder and ultrasound gel holder)	1 time/month	Ditto
6.	Cover cleaning	1 time/month	Ditto
7.	Peripherals cleaning	1 time/month	See *Chapter 11.2.2*
8.	Probe appearance check	1 time/day	See *Chapter 11.3.1*
9.	Check for power supply cable, power supply plug and circuit breaker.	1 time/month	See *Chapter 11.3.1*
10.	Battery check	1 time/3-6 month	See *Chapter 11.3.1*
11.	Check for peripherals and optional functions	1 time/year	See *Chapter 11.3.3*
12.	Mechanical safety check	1 time/year	See *Chapter 11.3.4*
13.	Check for electrical safety	1 time/year	See *Appendix A*

11.2 Cleaning

11.2.1 System Cleaning

11.2.1.1 Flow of Cleaning

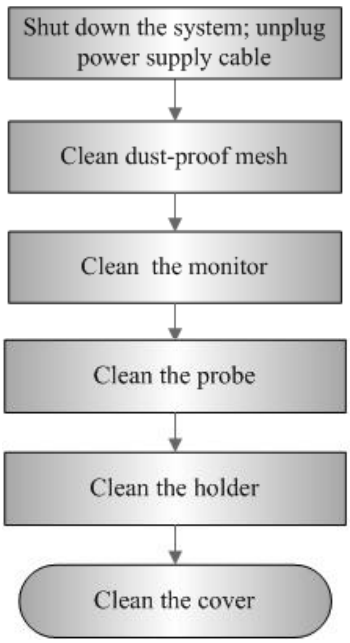


Fig 11-1 The View of cleaning maintenance

> ⚠**WARNING:** **Before cleaning the system, be sure to turn off the power and disconnect the power cord from the outlet. Otherwise electric shock may result.**

11.2.1.2 Content

1. Dust-proof mesh of main unit cleaning
   - Tool: soft brush
   - Disassembling Method: please see 8.2.2

> ⚠**CAUTION:** **Please clean all dust-proof covers of the system periodically (1 time per month); otherwise, system damage may result. Cleaning times can be increased when the system is used in the open air or somewhere dust is more.**

2. Clean the monitor (touch screen)
   - Tool: dry soft cloth, ethanol and neutral detergent.
   - Method:

   Use dry clean soft cloth to clean monitor (touch screen). If there are any stains, use the soft cloth with ethanol or neutral detergent to clean off. Then, air dry it.

   Note: Do not use residual chemicals or particles to clean

3. Cleaning the probe

- Tool: dry soft cloth, mild soap-suds
- Method:
    a) Use dry soft cloth to clean off the dust on probe head, connector cover and its cables.
    b) Use soft brush to clean off the dust on the terminal of the probe connector.
    c) If there are any stains, use the mild soap-suds to clean off the dust on the appearance of the cables and connector cover. Then air dry it.

Note: the probe connector cannot be clean with wet cloth.

4. Holder cleaning

- Tool: dry soft cloth, soft brush, mild soap-suds
- Method:
    a) Use soft dry cloth to clean off the dust on probe and gel holder and its gap; use the soft brush to clean off the dust from gaps and probe holders of smaller intracavity probes.
    b) If there are ant stains, remove the probe holder. Use mild soap-suds to clean off the stains. Reinstall it after being air dried.
    c) Gel heater: unplug the cable of gel heater, and take off the heater. Use the mild soap-suds to clean the heater. Use soft brush to clean the holes. Use soap-suds to clean off the stains, and reinstall it after air-dry.

5. Device cover cleaning

- Tool: dry soft cloth, mild soap-suds
- Method:

Use soft cloth to clean off the dust on the device cover (the part exposed).Or use mild soap-suds to clean off the stains and air dry it.

Note: it is preferred to use soft brush to clean off the dust on the port or socket rather than wet cloth (such as probe socket).

Compatible Disinfections used to clean the main unit

The disinfections supported to use when cleaning the housing and display of the system are listed in table below:

Manufacturer	Trade Name	Type
DR.SCHUMACHER.GMBH	Cleanisept WIPES	Wipe
Advanced Ultrasound Solutions, Inc.	SONO Ultrasound Wipes	Wipe

NOTE:	Disinfectants above are used to clean the housing and the display of the main unit only, not for the probe disinfection.

11.2.2 Peripherals Cleaning

Perform the cleaning according to the reality. The test items without the configurations can be ignored.

Table 11-4 List for peripherals cleaning

Item	Content	Process Description
1	Color/Black/White video printer	Use soft dry cloth to clean off the dust and stains on the cover. Remove the cover to clean the internal of the printer. It is necessary to abide by the operation procedures in *Operator's Manual* to clean the printer.
2	Graph/text printer	Use soft dry cloth to clean off the dust and stains on the cover. Remove the cover to clean the internal of the printer. It is necessary to abide by the operation procedures in *Operator's Manual* to clean the printer.
3	Footswitch	Use the dry soft cloth and soap-suds to clean off the dust and stains on footswitch and the cables.
4	Barcode reader	Use dry soft cloth to glass board of the scanner, and the clean off the dust o the cables and the bracket. Please abide by the operation manual on the scanner to perform the cleaning.

11.3 Check

11.3.1 General Check

Table 11-5 The list for general check

No.	Content	Method
1	Probe	Visual estimation, check whether there are any cracks and distention to probe head. Visual estimation, check whether there is aging or peeling; Visual estimation, check whether there is bending, damage or missed stitch to the probe's connector.
2	Power supply cable and socket	Visual estimation, check whether there are creases, cracks or aging to the power supply cable; Manual operation, check whether the plug of the power supply is fixed enough. No loose or crack occurs to it. The retaining clamp of power supply cable works well.
3	Battery	Checking battery performance routine: Charge the battery when the device is powered on: if the battery capacity reaches 100% or the battery continues to be charged, it indicates the battery works well. If the battery capacity is less than 90%, the time to increase 1% of battery capacity is less than 5 minutes. If the battery capacity is more than 90%, it need more to time to charge the battery. In stand-by status, the standby indicator shows the status of the battery.

11.3.2 System Function Check

The system function checking is not required during Preventive Maintenance. Engineer or Customer may use it as part of their product Quality Assurance Program tests.

Table 11-6 System function list

No.	Content	Method
1	B mode	Verify the basic operation in B mode. Check the basic software and hardware assembly affecting B-mode operation.
2	Color mode	Check the basic operation in Color mode. Check the basic software and hardware assembly affecting Color mode operation.
3	Doppler mode (PW/CW)	Verify basic operation in Doppler mode. Check the basic software and hardware assembly affecting Doppler mode operation.
4	M mode	Check the basic operation in M mode. Check the basic software and hardware assembly affecting M-mode operation.
5	Measurement (General measurement, optional application measurement for 2D, M, Doppler)	Gray scale scanning on the body mark mode verifies distance and the accuracy of calculation using the test assembly and checks test precision along with performance test.
6	Touchscreen test	Operate different controls on the touchscreen to view the responding
7	LCD	Please refer to LCD checking methods to check LCD display and parameters adjustments are normal.
8	Software menu testing	Testing software menu display is to see if they works normally after entering interfaces and menus
See *Chapter 5.4~5.5*		

11.3.3 Check for Peripherals and Optional Functions

If there is no relevant module or option in the system configuration, the relevant check can be ignored.

Table 11-7 Peripheral and option checking list

Item	Content	Method
1	Color/Black/White video printer	Check whether the output of video printer works well.
2	Graph/text printer	Check whether the output of graph/text printer works well.
3	Footswitch	Check whether the footswitch works as the system configures.
4	DVD-R/W	Check whether DVD-R/W works well (burning, read/write and openness).
5	Barcode reader	Check whether the reader works well and whether the output is correct.

Item	Content	Method
6	DICOM	Check whether DICOM works well, and verify if sending images to DICOM server by shortcut key is normal.
7	ECG module	Check user's basic operation. Verify the implementation of ECG module.
See *Chapter 5.3*		

11.3.4 Mechanical Safety Inspection

Mechanical safety inspection is mainly used to check mechanical strength and mechanical function of the key assembly of ultrasonic system. The mode of test evaluation mainly is: Perform the evaluation by means of visual check and operating check, if the check result cannot pass, the system is in abnormal status now. Stop using the system and adopt proper measures. The test flow is as following:

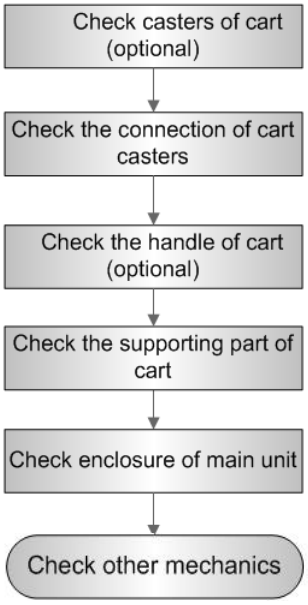

Check casters of cart (optional)
Check the connection of cart casters
Check the handle of cart (optional)
Check the supporting part of cart
Check enclosure of main unit
Check other mechanics

Fig Mechanical Safety Inspection Flow

The table of Mechanical Safety Check:

NO.	Item	Method	Tool
1.	Casters of cart	a) Visually check to confirm there is no any crack. b) Operate the casters to confirm the locking and releasing functions are normal.	none
2.	Connection of cart casters	a) Visually check to confirm that there is no skewness and the connecting screws are free of breakage or falling off. b) Check with the spanner to make sure that there is no looseness between the caster and the base connection screw.	Inner hexagon wrench 6
3.	Handle of cart	a) Check by sight if the handle has cracks.	

NO.	Item	Method	Tool
		b) Use a wrench to check if the handle is loose.	
4.	Cart supporting parts	a) Use hands to check if the supporting parts are loose.	none
5.	Enclosure of main unit	b) Check by sight if there is any crack.	none
6.	Other mechanical structures	Check to confirm that there is no looseness to other mechanical parts, no crack to cover and no conductive parts show in sight.	none

11.3.5 Electrical Safety Inspection

Only technical professionals or engineers after training can perform electric safety inspection. Please refer to appendix A: Electrical Safety Inspection for details.

12 Troubleshooting of Regular Malfunctions

12.1 Troubleshooting as the System is Disabled to Power On

12.1.1 Related Modules or Boards

No.	Descriptions	Remarks
1	Power supply adapter	/
2	Battery assembly	/
3	Main board	/
4	CPU assembly	/

12.1.2 Key Points Supporting Troubleshooting

No.	Key points supporting troubleshooting	Remarks
1	Main unit fan	sounds occur after power off
2	AC indicator	Located on the monitor ~

12.1.3 Troubleshooting as the System is Disabled to Power On

No.	Fault Description	Cause Analysis	Solution
1	System power supply adaptor AC power indicator remains off; The system starts to work, but it turns out that the battery supplies the power for the system.	1 No AC input 2 Error from power supply adaptor	1 Re-check the connection of AC 2 Replace the power supply adaptor

2	AC indicator: on; No sound of the fan heard after pressing the power button.	Error from main board of power supply;	Replace the main board.
3	AC indicator: on; The fan makes the sound after pressing the power button. No display shows.	Main board of power supply responds to the power on/off, but CPU module does not respond to the power on/off module. The possibility for CPU module error is comparatively higher.	Replace CPU module or the main board
4	When connecting to the power supply adaptor, the system works well. If not connecting to the power supply adaptor, the system does not work only with the supply of the battery.	1 Low battery capacity 2 Battery module error	1 Charge the battery module; 2 Replace the battery module

12.2 The System Cannot Perform Troubleshooting

12.2.1 Related Modules or Boards

No.	Descriptions	Remarks
1	Main board	/
2	CPU assembly	/
3	SSD	/

12.2.2 Key Points Supporting Troubleshooting

No.	Key points supporting troubleshooting	Remarks
1	Character and progress status during the starting of the system	/
2	Alarm and prompts during the starting of the system	/
3	The fan of the main unit makes the sound.	/
4	Display mode of the LCD	/

12.2.3 The System Cannot Perform Troubleshooting

No.	Fault Description	Cause Analysis	Solution
1	The fan makes the sound. The display is blank. Connect a keyboard via USB port. Press [Num Lock] to view the indicator of the keyboard.	CPU starts working if there is the responding. Main board error. Or, CPU assembly error.	Replace CPU module or the main board
2	BIOS start-up graphics is normally displayed, but it cannot be kept on	CPU module error	Replace CPU module
3	“OPERATING SYSTEM NOT FOUND” appears.	Loading operation fails. SSD and root directory of SSD in operation system are damaged.	Restore the operating system. If fails, replace SSD.
4	BIOS start-up graphics appears, and then in black screen.	Unavailable to load the system. The system directory of SSD may be damaged.	Restore the operating system. If fails, replace SSD.
5	System Doppler start-up graphics displays but cannot be kept on.	Fails to load Doppler software. SSD or system software of SSD may be damaged.	Restore the operating system. If fails, replace SSD.

12.3 Image Troubleshooting

12.3.1 Related Modules or Boards

No.	Descriptions	Remarks
1	PHV power supply board	/
2	Probe board	/
3	Main board	/

12.3.2 Key Points Supporting Troubleshooting

No.	Key points supporting troubleshooting	Remarks
1	Image feature, including dark strips and noise	/
2	The imaging features of various probes	/

12.3.3 Image Troubleshooting

No.	Fault Description	Cause Analysis	Solution
1	No echo to ultrasound image. The probe can recognize but without the echo.	PHV power supply board error	Replace PHV power supply board
2	Dark strips appear on B image	Probe malfunction, e.g., array damage, etc. Replace the probe to eliminate the error.	Replace the probe;
		If dark strips appear in the near field and distribute regularly, transmission channels cannot generate transmission waveforms;	Replace probe or main board;
		If dark strips appear in the far field and distribute regularly, Receiving channel error. Some channels do not receive or produce echo signal.	Replace probe or main board;
3	Noise appears in B image	Probe malfunction. Replace with different probes to check the problem.	Replace the probe;
		Other electrical equipment in the voltage is working, so that the probe may be interfered on the floor; Displays ripple-shaped interference signal on the image	Confirm the cause of failure by turning off electrical equipment of all peripherals connected to the system

12.4 Troubleshooting touchscreen board

12.4.1 Related Modules or Boards

No.	Descriptions	Remarks
1	Touchscreen	/
2	Touch Pad	/
3	Main Board	/
4	PC module	/

12.4.2 Key Points Supporting Troubleshooting

No.	Key points supporting troubleshooting	Remarks
1	Icons on the display	Used for confirming that each touch spot responds with the corresponding icon.

12.4.3 Touchscreen Troubleshooting

No.	Fault Description	Cause Analysis	Solution
1	No responding on the touchscreen.	1 FPC falling 2 Touch pad abnormality 3 Touchscreen abnormality	1 Check FPC. If necessary, reinstall it. 2 Replace touch pad. 3 Replace touchscreen assembly.
2	No responding on the touchscreen after touching a few spots on the screen.	1 Poor connection of FPC 2 FPC wearing 3 Touchscreen abnormality	1 Check FPC. If necessary, reinstall it. 2 Replace touchscreen assembly. 3 Replace touchscreen assembly.
3	Touching spot is inconsistent with the responding.	1 Poor connection of FPC 2 Touchscreen abnormality	1 Check FPC. If necessary, reinstall it. 2 Replace touchscreen assembly.
4	Jump point. Mishandling without touching.	1 FPC abnormality 2 Power supply abnormality 3 Strong electrical interference	1 Check FPC. If necessary, reinstall it. 2 Check power supply status 3 Check other electrical devices.

12.5 Troubleshooting LCD Display

12.5.1 Related Modules or Boards

No.	Descriptions	Remarks
1	Display (monitor) assembly	/
2	Main board	/
3	CPU assembly	/

12.5.2 Key Points Supporting Troubleshooting

No.	Key points supporting troubleshooting	Remarks
1	Backlight of the LCD	More evident in the darkness
2	Display the status via HDMI connecting to peripherals;	/

12.5.3 Troubleshooting Monitor

No.	Fault Description	Cause Analysis	Solution
1	Noises of the fan heard. No display (blank screen) on the LCD; Displays normally via HDMI connecting to peripherals;	LCD error	Replace the LCD.
2	The fan makes sound No display (blank screen) on the LCD; Displays normally via HDMI connecting to peripherals;	Main board or PC assembly error	Replace the main board or PC assembly.

Appendix A Electrical Safety Inspection

The following electrical safety tests are recommended as part of a comprehensive preventive maintenance program. They are a proven means of detecting abnormalities that, if undetected, could prove dangerous to either the patient or the operator. Additional tests may be required according to local regulations.

All tests can be performed using commercially available safety analyzer test equipment. These procedures assume the use of a 601PRO$_{XL}$ International Safety Analyzer or equivalent safety analyzer. Other popular testers complying with IEC 60601-1 used in Europe such as Fluke, Metron, or Gerb may require modifications to the procedure. Follow the instructions of the analyzer manufacturer.

The consistent use of a safety analyzer as a routine step in closing a repair or upgrade is emphasized as a mandatory step if an approved agency status is to be maintained. The safety analyzer also proves to be an excellent troubleshooting tool to detect abnormalities of line voltage and grounding, as well as total current loads.

ELECTRICAL SAFETY INSPECTION 1- Power Cord Plug	
TEST PROCEDURE	
● The Power Plug	
The Power Plug Pins	No broken or bent pin. No discolored pins.
The Plug Body	No physical damage to the plug body.
The Strain Relief	No physical damage to the strain relief. No plug warmth for device in use.
The Power Plug	No loose connections.
● The Power Cord	
The Power Cord	No physical damage to the cord. No deterioration to the cord. --For devices with detachable power cords, inspect the connection at the device. --For devices with non-detachable power cords, inspect the strain relief at the device.

ELECTRICAL SAFETY INSPECTION 2- Device Enclosure And Accessories	
TEST PROCEDURE	
● Visual Inspection	
The Enclosure and Accessories	No physical damage to the enclosure and accessories.
	No physical damage to meters, switches, connectors, etc.
	No residue of fluid spillage (e.g., water, coffee, chemicals, etc.).
	No physical damage to probe head (e.g., crack)
	No loose or missing parts (e.g., knobs, dials, terminals, etc.).
● Contextual Inspection	
The Enclosure and Accessories	No unusual noises (e.g., a rattle inside the case).
	No unusual smells (e.g., burning or smoky smells, particularly from ventilation holes).
	No taped notes that may suggest device deficiencies or operator concerns.

ELECTRICAL SAFETY INSPECTION

3- Device Labeling

TEST PROCEDURE

Check the labels provided by the manufacturer or the healthcare facility is present and legible.

- *Main Unit* Label
- *Integrated Warning* Labels
- *Slope and High Voltage Caution* Label
- *Don't Stress* Label

NOTE: “4-protective grounding impedance” testing item is applicable for TE7 portable ultrasound system with UMT-400 trolley, and is not applicable for unaccompanied TE7 system.

ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

VOERVIEW

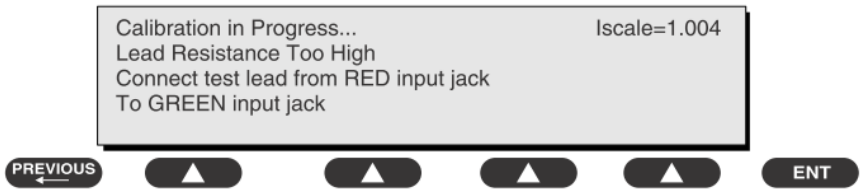
Protective Earth Resistance is measured using the RED test lead attached to the DUT Protective Earth terminal or Protective Earth Metal enclosure or equipotential terminal. The only grounding conductor resistance test of TE7 trolley is the GND which lies on the auxiliary outlet. Select the test current by pressing SOFT KEY 3 to toggle between 1AMP, 10AMP, and 25AMP. The front panel outlet power is turned off for this test.

The following conditions apply: L1 and L2 Open.

TEST PROCEDURE

- Prepare

1) First select the test current that will be used for performing the Protective Earth Resistance test by pressing AMPERES (SOFT KEY 3).
2) Connect the test lead(s) between the RED input jack and the GREEN input jack.
3) Press CAL LEADS. The 601PRO will measure the lead resistance, and if less than 0.150 Ohms, it will store the reading and subtract it from all earth resistance readings taken at the calibrated current.



4) If the calibration fails, the previously stored readings will be used until a passing calibration has occurred.

◆ Warning

During Earth Resistance testing, the DUT must be plugged into the 601PRO front outlet. If the DUT fails Earth Resistance, discontinue tests and label the device defective.

- Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet.

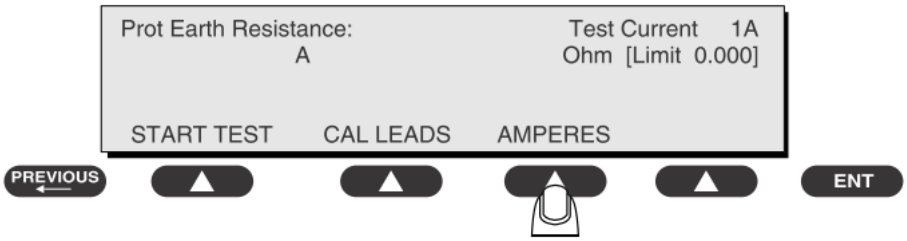
ELECTRICAL SAFETY INSPECTION

4- Protective Earth Resistance

2) Attach the 601PRO RED input lead to the device's Protective Earth terminal or an exposed metal area.

3) Press shortcut key 3. The Protective Earth Resistance test is displayed.

4) Press SOFT KEY 3 to select a test current (1AMP, 10AMP, or 25AMP). The selected test current is displayed in the upper right corner of the display.



5) Press START TEST to start the test. The test current is applied while resistance and current readings are taken. This takes approximately 5 seconds.

6) Press the print data key at any time to generate a printout of the latest measurement(s).

- Note

When "Over" is displayed for Ohms, this signifies that a valid measurement was not obtained because either an open connection was detected or that the measurement was not within range. Readings greater than 9.999 Ohms will be displayed as Over.

- Failure

Once it reaches the limitation, stop using equipment. Check the protective earth connection between Protective Earth terminal and Protective Earth Metal enclosure and equipotential terminal; Retest and inform the Customer Service Engineer for analysis and disposal if still fail.

LIMITS

ALL COUNTRIES R = 0.2Ω Maximum

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

OVERVIEW

Run an Earth Leakage test on the device being tested before performing any other leakage tests.

Leakage current is measured the following ways:

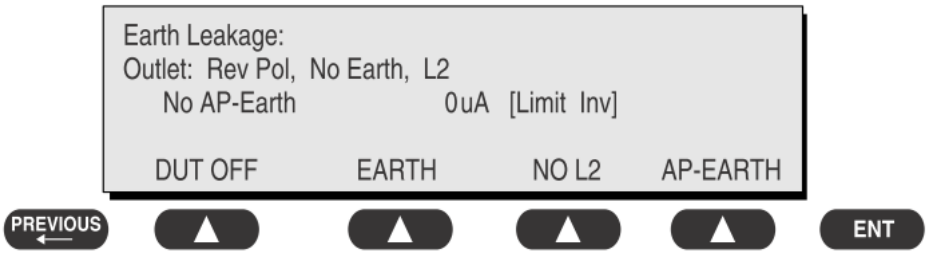
- ♦ Earth Leakage Current, leakage current measured through DUT outlet Earth
- ♦ Earth Leakage Current AP-EARTH (ALL Applied Parts connected to Earth), leakage current measured through DUT outlet Earth

There is no need to attach a test lead; the 601PRO automatically connects the measuring device internally.

TEST PROCEDURE

- Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the device's applied parts to the 601PRO applied part terminals if applicable.
3) Press shortcut key 4.The Earth Leakage test appears on the display, and the test begins immediately:



- ➢ SOFT KEY 1 toggles the DUT outlet Polarity from Normal to Off to Reverse.
- ➢ SOFT KEY 2 toggles the DUT outlet from Earth to No Earth.
- ➢ SOFT KEY 3 toggles the DUT outlet from L2 to No L2.
- ➢ SOFT KEY 4 toggles the AP to Earth to No AP to Earth.

4) Press the print data key at any time to generate a printout of the latest measurement.

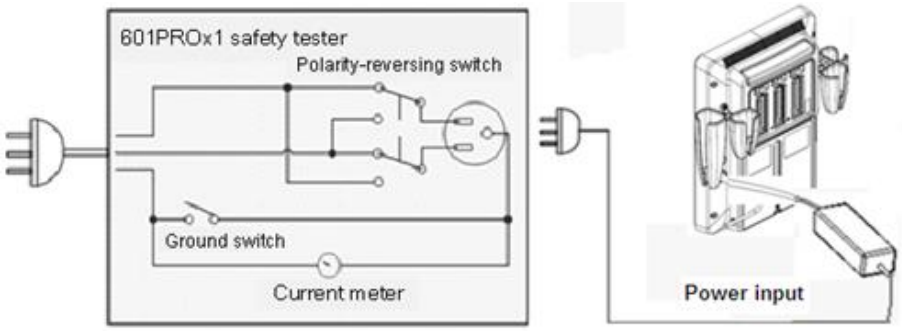


Figure 1 Earth leakage test

ELECTRICAL SAFETY INSPECTION

5- Earth Leakage Test

- Failure

Check any short-circuits of the Y capacitor on power unit. Replace a new one if any portion defective.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect mains wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect mains wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation cannot be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

IEC60601-1:： 500 μA Normal Condition

1000 μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

OVERVIEW

Patient leakage currents are measured between a selected applied part and mains earth. All measurements may have either a true RMS.

TEST PROCEDURE

- Prepare

Perform a calibration from the Mains on Applied Part menu.

The following outlet conditions apply when performing this test:

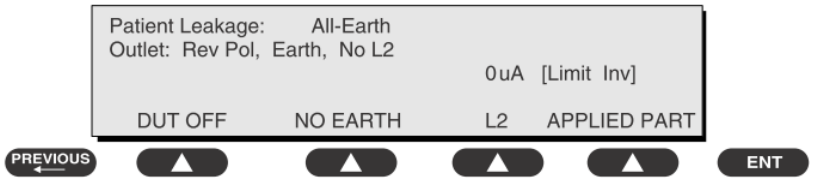
Normal Polarity, Earth Open, Outlet ON	Normal Polarity, Outlet ON
Normal Polarity, L2 Open, Outlet ON	Reversed Polarity, Outlet ON
Reversed Polarity, Earth Open, Outlet ON	Reversed Polarity, L2 Open, Outlet ON

● Warning

If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

- Perform the Test

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the applied parts to the 601PRO's applied part terminals.
3) Press shortcut key 6. The Patient Leakage test is displayed, and the test begins immediately.



4) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current.
5) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO.

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

6) Press the print data key at any time to generate a printout of the latest measurement.

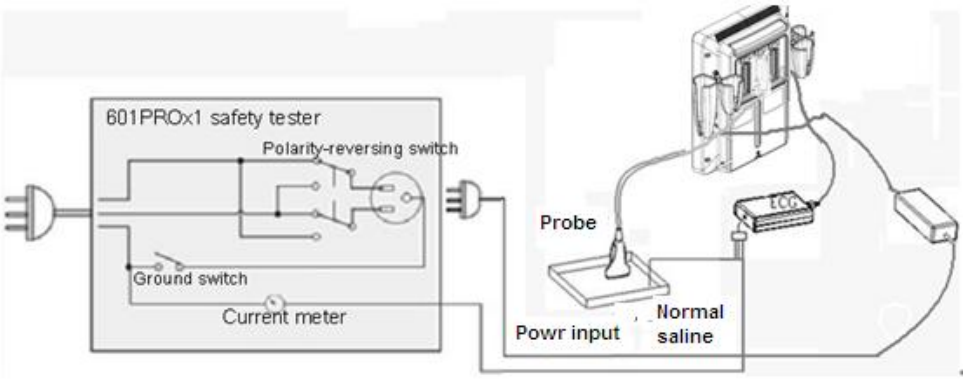


Figure 2 patient leakage Current

- Note

1, In addition to Probes ,Patient leakage current test should be perform if ECG or PCG parts used;

2, If the current test standard being used does not include Patient Leakage DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections. Refer to Chapter 8, Standards and Principles.

- Failure

Check any broken of the Applied parts. Replace any defective one.

Check any broken of the ECG/PCG module if used, Replace any defective one.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation cannot be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

ELECTRICAL SAFETY INSPECTION

6- Patient Leakage Current

LIMITS
All countries For BF ECG input and transducer 100µA Normal Condition 500µA Single Fault Condition

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

OVERVIEW

The Mains on Applied Part test applies a test voltage, which is 110% of the mains voltage, through a limiting resistance, to selected applied part terminals. Current measurements are then taken between the selected applied part and earth. Measurements are taken with the test voltage (110% of mains) to applied parts in the normal and reverse polarity conditions as indicated on the display.

The following outlet conditions apply when performing the Mains on Applied Part test.

Normal Polarity;

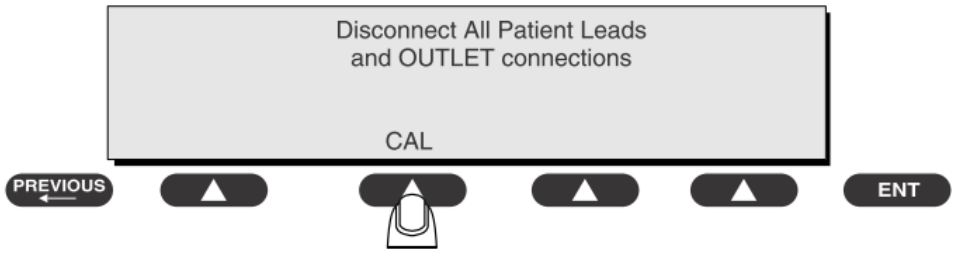
Reversed Polarity

TEST PROCEDURE

- Prepare

To perform a calibration from the Mains on Applied Part test, press CAL (SOFT KEY 2).

1) Disconnect ALL patient leads, test leads, and DUT outlet connections.
2) Press CAL to begin calibration, as shown:



If the calibration fails, the previously stored readings will be used until a passing calibration has occurred. Also, the esc/stop key has no effect during calibration.

3) When the calibration is finished, the Mains on Applied Part test will reappear.

● Warning

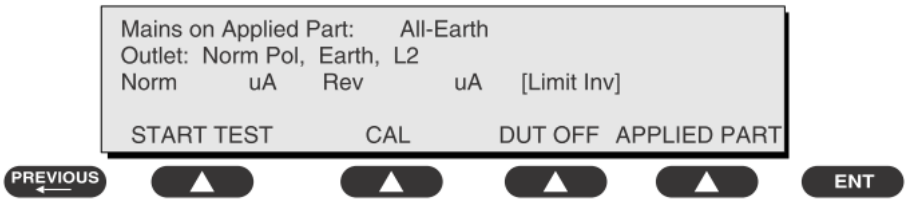
1) A 2-beep-per-second signal indicates high voltage present at the applied part terminals while a calibration is being performed.
2) High voltage is present at applied part terminals while measurements are being taken.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

- Performance

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601
2) Attach the applied parts to the 601PRO applied part terminals.
3) Press shortcut key 7. The Mains on Applied Part test is displayed.



4) Select the desired outlet configuration and applied part to test using the appropriate SOFT KEYS:
5) Press START TEST (SOFT KEY 1) to begin the test.
6) Press the print data key to generate a printout of the latest measurement.

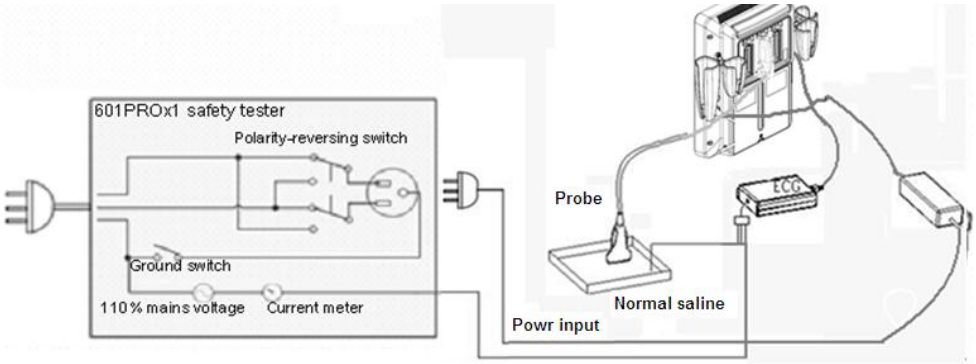


Figure 3 Mains on Applied part leakage

- Note

1, In addition to Probes ,Patient leakage current test should be perform if ECG or PCG parts used;

2, If all of the applied parts correspond to the instrument type, the applied parts will be tied together and one reading will be taken. If any of the applied parts differ from the instrument type, all applied parts will be tested individually, based on the type of applied part. This applies to Auto and Step modes only.

- Failure

Check any broken of the Applied part. Replace any defective one.

Check any broken of the ECG/PCG module if used, Replace any defective one.

Check any broken of the Power Unit. Replace a new one if any portion defective.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities.

ELECTRICAL SAFETY INSPECTION

7- Mains on Applied Part Leakage

Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation cannot be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

All countries:

For BF ECG input and transducer:

5000μA

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

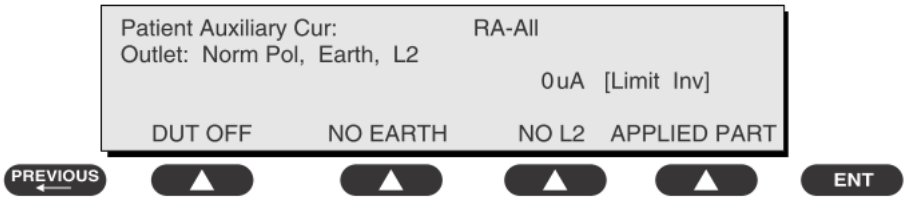
overview

Patient Auxiliary currents are measured between any selected ECG jack and the remaining selected ECG jacks. All measurements may have either a true RMS or a DC-only response.

TEST PROCEDURE

- Prepare

1) From the MAIN MENU, or with the outlet unpowered, plug the DUT into the 601PRO front panel outlet, and turn on the device.
2) Attach the patient leads to the 601PRO ECG jacks.
3) Define the Lead Types from the View Settings Option (refer to: Lead Type Definitions in Section 5 of this chapter).
4) Press shortcut key 8. The Patient Auxiliary Current test is displayed, and the test begins immediately. Display values are continuously updated until another test is selected.



5) Press SOFT KEYS 1-4 to select leakage tests
6) Press APPLIED PART (SOFT KEY 4) at any time to select the desired applied part leakage current:
7) Modify the configuration of the front panel outlet by pressing the appropriate SOFT KEY on the 601PRO:
8) Press the print data key at any time to generate a printout of the latest measurement.

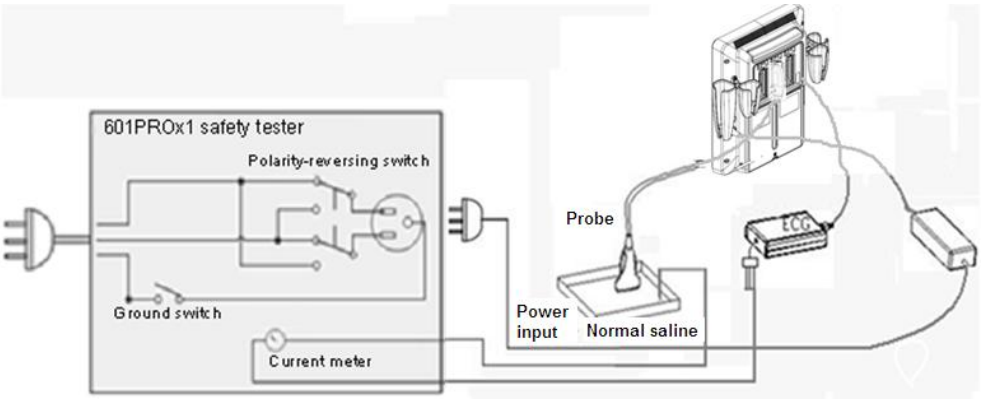


Figure 4 patient Auxiliary Current

ELECTRICAL SAFETY INSPECTION

8- Patient Auxiliary Current

- Note

If the current test standard being used does not include Patient Auxiliary Current DC readings, or the DC option is not enabled, then DC readings will not be available through the APPLIED PART SOFT KEY selections.

- Failure

Check any broken of the AC cable. Replace a new one if any portion defective.

Check any broken of the enclosure. Replace any defective part.

Inspect wiring for bad crimps, poor connections, or damage.

Test the wall outlet; verify it is grounded and is free of other wiring abnormalities. Notify the user or owner to correct any deviations. As a work around, check the other outlets to see if they could be used instead.

Change another probe to confirm if the fail is caused by console.

Inspect wiring for bad crimps, poor connections, or damage.

If the leakage current measurement tests fail on a new unit and if situation cannot be corrected, submit a Safety Failure Report to document the system problem. Remove unit from operation.

If all else fails, stop using and inform the Customer Service Engineer for analysis and disposal.

LIMITS

All countries

For BF ECG input and transducer

100μA Normal Condition

500μA Single Fault Condition

ELECTRICAL SAFETY INSPECTION FORM

（Class I equipment）

Overall assessment:

□ Scheduled inspection Test item: 1, 2, 3

□ Unopened repair type Test item: 1, 2, 3

□ Opened repair type, not modify the power part including transformer or patient circuit board Test item: 1, 2, 3, 4, 5

□ Opened repair type, modify the power part including transformer or patient circuit board Test item: 1, 2, 3, 4, 5, 6, 7, 8

Location:				**Technician:**	
Equipment:				**Control Number:**	
Manufacturer:		**Model:**		**SN:**	
Measurement equipment /SN:				**Date of Calibration:**	
INSPECTION AND TESTING				**Pass/Fail/NA**	**Limit**
1	Power Cord Plug				
2	Device Enclosure and Accessories				
3	Device Labeling				
4	Protective Earth Resistance		Ω		Max 0.2 Ω
5	Earth Leakage	Normal condition(NC)	____μA		Max: NC: 300μA(refer to UL60601-1) * NC: 500μA(refer to IEC60601-1) * SFC: 1000μA
		Single Fault condition(SFC)	____μA		
6	Patient Leakage Current	Normal condition(NC)	□BF___μA		Max: BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	□BF___μA		
7	Mains on Applied Part Leakage		□BF___μA		Max: BF applied part: 5000μA
8	Patient Auxiliary Leakage Current	Normal condition(NC)	□BF___μA		Max: BF applied part: NC:100μA, SFC: 500μA
		Single Fault condition(SFC)	□BF___μA		

Note:

- 4-protective grounding impedance testing is applicable for TE7 + UMT-400 trolley and is not applicable for unaccompanied TE7 system or TE7 system with UMT-400 trolley (without power supply).
- **The equipment which sell to America shall comply with the requirement of UL60601-1, others shall comply with the requirement of IEC60601-1.**

Name/ Signature: _____Date:_____

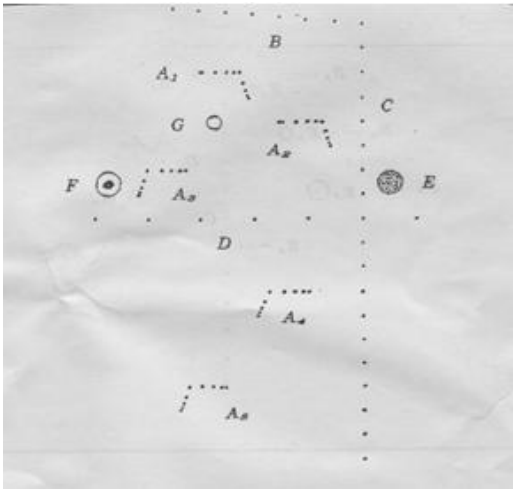
Appendix B Phantom Usage Illustration

Note: as an option, the phantom usage is not required to perform the routine maintenance. It can be used to guarantee the quality of the test.

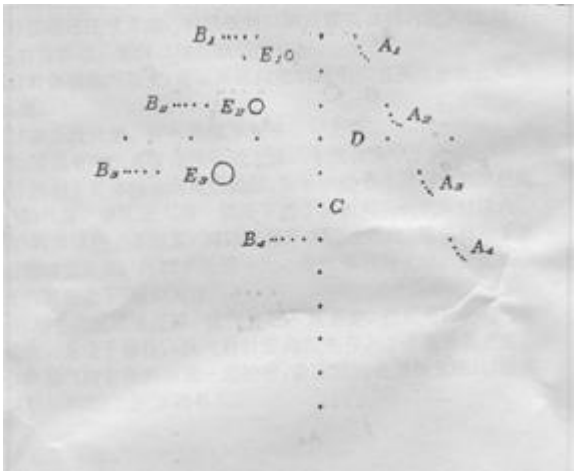
Note:	Best storage and working temperature for phantom: 10℃ to 35℃. The test performance may be affected if the temperature goes beyond the range.

⚠WARNING:	**1.**	**Lay the probe gently on the acoustic window in the use. In case of acoustic window and TM damage, do not press acoustic window.**
	2.	**Do not let the phantom fall off or bump. Do not put the phantom upside down except for the maintenance.**

Targets disposal- KS107BD



Targets disposal- KS107BG



Appendix C Description of Self-test Test Items

C.1.1 Z0101 Hard Disk Verify Test

1. Top test items

   N/A

2. Test content

   Traverse all hard disk files from Doppler installation directory, compare and verify the files with the archived hard disk data.

   - Analysis to test failure

   If the system prompts "*Failed to open the result file*", the verification file does not exist. If the system prompts *"The failed CRC: current verification value (failed file path, correct verification value)"*, the hard disk data is damaged.

3. Suggestion to test failure

   Restore the hard disk data; replace the file from M6 directory in C local disk with the *CRC_Result.txt* from the restore package.

C.1.2 Z0201 PC Module and DSP FPGA Interconnection Test

1. Top test items

   N/A

2. Test content

   Test whether communication between PC module and DSP FPGA works well.

   - Analysis to test failure

   Check whether *Windows* device manager recognizes *Ultrasound Backbone Device*. If the driver is not installed properly, it cannot be recognized.

   The driver goes wrong if the test result appears *Error*.

   PC module and DSP FPGA has communication error if the test result is *FAIL*.

3. Suggestion to test failure

   a) Restore Doppler software if the driver is not recognized.

   b) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   c) It is recommended to replace CPU if the test result is *FAIL*.

C.1.3 Z0202 DSP FPGA DDRIII Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Perform read and write tests for entire space of four types of DDRs that DSP FPGA plugs in. The program displays the test results of DSP buffer DDR (transmitting DSP processing result data), SCAN buffer DDRIII (transmitting scan control frame), IQ buffer DDRIII (transmitting IQ data) and Gather buffer DDRIII (collecting data).

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The system will prompt DDR is wrong (DSP buffer DDRIII test <test result>;SCAN buffer DDRIII test <test result>;IQ buffer DDRIII test <test result>;Gather buffer DDRIII test <test result>.) if the test result is *FAIL*. It means the connection error between FPGA and plug-in DDR occurs.

3. Suggestion to test failure

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace CPU if the test result is *FAIL*.

C.1.4 Z0203 DSP FPGA SSRAM Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Perform read and write tests for entire space of SSRAM of DSP FPGA.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The connection error between FPGA and plug-in SSRAM occurs if the test result is *FAIL*.

3. Suggestion to test failure

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to change CPU if the test result is *FAIL*.

C.1.5 Z0204 DSP FPGA and TR Interconnection Test (Control Interface)

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Test whether the control bus communication between DSP FPGA and XCVER of TR FPGA works well via reading the register.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The connection error between DSP FPGA and TR FPGA occurs if the test result is *FAIL*.

3. Suggestion to failure test

a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

b) It is recommended to change CPU if the test result is *FAIL*.

C.1.6 Z0205 AFE SPI Interface Test

1. Top test items

   DSP FPGA and TR Interconnection Test (Control Interface)

2. Test content

   Test whether the SPI control bus communication between TR FPGA and AFE works well via reading the registering.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   TR FPGA and AFE's SPI bus have communication error if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to change CPU if the test result is *FAIL*.

C.1.7 Z0206 AFE Digital Interface Test

1. Top test items

   AFE SPI Interface Test

2. Test content

   Enter system test mode, write the data to TR AFE, input delay RAM, re-read the data from delay-channel memory and make the judgment to locate the channel and AFE clip.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The system will prompt "TR AFE digital interface test FAIL. AFE<which AFE> Broken; Broken channel: <detective channels>." if the test result is *FAIL*. It means AFE clip goes wrong.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error*, which indicates the logic error of DSP FPGA occurs. It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace CPU if the test result is *FAIL*.

C.1.8 Z0207 ATGC Function Test

1. Top test items

   DSP FPGA and PHV ARM Interconnection Test, AFE Digital Interface Test

2. Test content

   Collect the noise that AFE receives as setting ATGC to max, min and medium value. Judge whether noise changes as ATGC increases according to the analysis on RMS value.

- Analysis to test failure

The driver goes wrong if the test result appears *Error*.

The circuit of ATGC gain adjustment goes wrong if the test result is *FAIL*.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) It is recommended to change CPU if the test result is *FAIL*.

C.1.9 Z0208 DSP FPGA and ARM Interconnection Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Test whether UART communication between DSP FPGA and SM ARM works well. Send the order through SM serial port driver, and re-read the data via the serial port.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   UART interconnection between DSP FPGA and SM ARM goes wrong if the test fails.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) It is recommended to replace CPU if the test result is *FAIL*.

C.1.10 Z0209 DSP FPGA and ADT7462 Interconnection Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Test whether SM Bus communication between DSP FPGA and ADT7462 works well. Send the order through SM Bus driver, and re-read the data via SM Bus.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   SM Bus interconnection between DSP FPGA and ADT7462 goes wrong if the test fails.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) It is recommended to replace CPU if the test result is *FAIL*.

C.1.11 Z0210 System Voltage Test

1. Top test items

   DSP FPGA and ARM Interconnection Test, DSP FPGA and ADT7462 Interconnection Test

2. Test content

   Read the voltage values of P2V5, N11V7, P3V3, P5V, P1V2 and P1V8 via SM serial port driver. Read the voltage values of AP5V6, N5V6, AP3V6(3.8V), P12V, P1V5, AP2V, AP2V8, VBAT, P1V and P1V35 via ADT7462 driver. Judge whether they meet the requirements.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The system will prompt “System Voltage Moniter Test FAIL. Main Board <expected voltage> Current Voltage: <actual voltage>, Limit Voltage: <limits>;” if the test result appears *FAIL*. It means the voltage value does not meet the requirement.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace CPU if the test result is *FAIL*.

C.1.12 Z0211 Fan Speed Test

1. Top test items

   DSP FPGA and ARM Interconnection Test

2. Test content

   Read rotational speed values of six monitoring fans via SM serial port driver, and judge whether they meet the requirements. From left to right, there lie fan 0 to fan 4 respectively, and the fan inside the device is fan 5.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*

   The system will prompt “Fan Speed test FAIL. <which fan> Current speed : <fan speed> rpm. …” if the test result is *FAIL*. It means the fan rotational speed does not meet the requirement.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error*, which indicates the error of SM serial port driver occurs. It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to repair the fan, which does not meet the requirements of rotational speed, if the test result is *FAIL*.

C.1.13 Z0212 TEE Angel Signal Test

1. Top test item

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Read the value of TEE angel signal. The collecting of the TEE angel signal works well if the value keeps stable.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The interconnection of TEE angel signal goes wrong if the test appears FAIL.

3. Suggestion to failure test

a) Restart the device to perform the self test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

b) It is recommended to replace the main board if the test result is *FAIL*.

C.1.14 Z0213 TEE Temperature Signal Test

1. Top test item

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Read the value of TEE temperature signal. The collecting of the TEE temperature works well if the value keeps stable.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The interconnection of TEE temperature signal goes wrong if the test appears FAIL.

3. Suggestion to failure test

   a) Restart the device to perform the self test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace the main board if the test result is *FAIL*.

C.1.15 Z0214 DSP FPGA and TR FPGA Interconnection Test (Data Interface)

1. Top test item

   AFE Digital Interface Test

2. Test content

   Test whether XCVER data interface between TR FPGA on the main board and DSP FPGA works well.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   XCVER data interface on the connection of TR FPGA-DSP FPGA goes wrong if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device to perform the self test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace CPU if the test result is *FAIL*.

C.1.16 Z0215 TR Transmission and Reception Function Test

1. Top test item

   ATGC Function Test

2. Test content

Test the coherence of 64 channels in transmitting and receiving: one channel transmits 2V 1M PHV1 waveform each time, and analyzes whether the waveform is PHV1, and compares the signal-to-noise ratio of this channel with others'.

- Analysis to test failure

The driver goes wrong if the test result appears *Error*.

The waveform that the channel transmits is incorrect if the information "Open circuit of transmitting and receiving channel: XXX" appears.

The transmission of this channel affects other channels if the information "Short circuit of transmitting and receiving channe: XXX" appears.

3. Suggestion to failure test

   a) Restart the device to perform the self test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace the main board if the test result is *FAIL*.

C.1.17 Z0216 Speaker Test

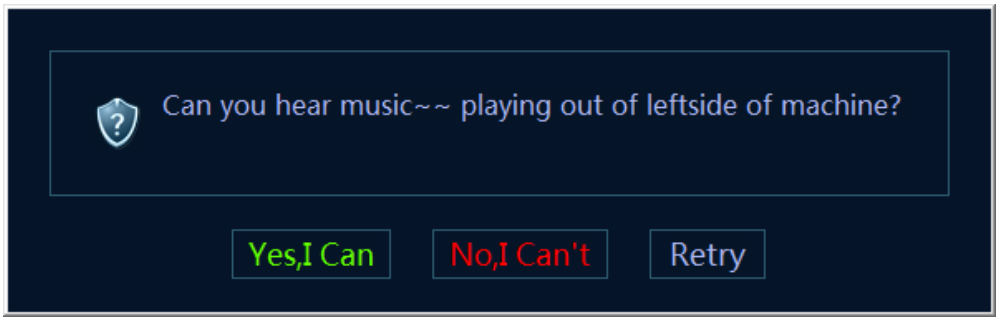
1. Top test items

   N/A

2. Test content

   Play the music by pressing the speaker from left or right side. Test whether audio clip, amplifier circuit or speaker function works well.

   The dialog box appears from either left or right side to inquire the audibility of the speaker. If it is inaudible, click [Retry] to re-play the track of the music. If it fails after many times play, click [No, I Can't]. If it is audible, click [Yes, I Can].



- Analysis to test failure

The audio module or the speaker does not work well if the test result is *FAIL*. The test person need to jude if the sounds is heard normal during the test.

3. Suggestion to failure test

   It is recommended to check the speaker and wire material first, and then check CPU and COME module.

C.1.18 Z0217 WIFI Function Test

1. Top test items

   N/A

2. Test content

   Judge whether the wireless network adapter exists, and then search for SSID list.

- Analysis to test failure

The wireless network adaptor cannot be recognized if information “There is no wireless device” appears.

WIFI hotspot cannot be found if information “WIFI Function test FAIL” appears.

3. Suggestion to failure test
   a) Check whether the connection of wireless network adaptor is fixed well and wireless network adaptor is not forbidden if the information “There is no wireless device” appears.
   b) Check whether there is WIFI hotspot if the information “WIFI Function test FAIL” appears. If there is a hotspot, replace the wireless network adaptor.

C.1.19 Z0218 Network Interface Test

1. Top test item

   N/A

2. Test content

   The program informs to plug in the network cable. The program decides the existence of the wired network adapter, and then decides whether the Ethernet works well.

   ■ Analysis to test failure

   The Ethernet cannot be recognized if the information “*No network adapter found*” appears.

   The network cable cannot be recognized if the information “*No network cable plugged in*” appears.

   Ethernet does not work well if the test appears *FAIL*.

3. Suggestion to failure test

   Please check the installation of the network driver if the information “*No network adapter found*” appears.

   Please check the network cable if the information “*No network cable plugged in*” appears.

   It is recommended to replace main board if the test result appears *FAIL*.

C.1.20 Z0301 DSP FPGA and PHV ARM Interconnection Test

1. Top test item

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Test whether UART communication between DSP FPGA and PHV ARM works well. Send the order through PHV serial port driver, and re-read the data via the serial port.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   UART interconnection between DSP FPGA and PHV ARM goes wrong if the test fails.

3. Suggestion to failure test
   a) Restart the device to perform the self test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

b) It is recommended to replace PHV power board if the test result is *FAIL*.

C.1.21 Z0302 PHV Board CW Mode Test

1. Top test items

   DSP FPGA and PHV ARM Interconnection Test

2. Test content

   Adjust the voltage of CW mode linearly, and set four voltage values. Read PHV1P and PHV1N voltage value via PHV serial port driver.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The voltage value of CW mode does not meet the requirement if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace PHV power board if the test result is *FAIL*.

C.1.22 Z0303 PHV Board PHV Mode Test

1. Top test items

   DSP FPGA and PHV ARM Interconnection Test

2. Test content

   Adjust PHV voltage linearly, and set five voltage values. Read PHV1P, PHV1N, PHV2P and PHV2N voltage value via PHV serial port driver.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The voltage value of PHV mode does not meet the requirement if the test result appears *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace PHV power board if the test result is *FAIL*.

C.1.23 Z0304 PHV Board HV Test

1. Top test items

   DSP FPGA and PHV ARM Interconnection Test

2. Test content

   Read positive and negative high-voltage value via PHV serial port driver.

   ■ Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The positive and negative 100 V does not meet the requirement if the test result is *FAIL*.

3. Suggestion to failure test

a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

b) It is recommended to replace PHV power board if the test result is *FAIL*.

C.1.24 Z0401 DSP FPGA and Probe Board CPLD Interconnection Test

1. Top test item

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Test whether SPI interface communication between DSP FPGA on engine board and CPLD on probe board works well

   - Analysis to test failure

   If “No probe board found” appears, it indicates the probe board is not recognized.

   The driver goes wrong if the test result appears *Error*.

   Interconnection between DSP FPGA and CPLD goes wrong if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device to perform the self test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to check the connection between probe board and the main board, and then consider changing probe board if the test result is *FAIL*

C.1.25 Z0501 LCD Monitor I2C Interconnection Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   Read the display data from 12C bus, and judge whether it belongs to non 0 or non F, and then parse LCD model, panel sequence number and LCD version number.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The interconnection between DSP FPGA and LCD monitor goes wrong if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) Check whether the connecting material between LCD monitor and main unit is fixed well if the test result is *FAIL*.

C.1.26 Z0502 LCD Monitor Adjust Data Check Test

1. Top test items

   LCD Monitor I2C Interconnection Test

2. Test content

The logic judges the progress status of the monitor and judges whether FLASH data is consistent with the data on EEPROM via reading the register.

- Analysis to test failure

The driver goes wrong if the test result appears *Error*.

Data calibration is incorrect if the test result appears *Error*.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) Check whether the screen is calibrated, and then replace the main board if the test result is *FAIL*.
   c) Check whether LCD paremeter board is connected normally, and then check the connection between LCD screen and the main board, and consider changing LCD screen at last.

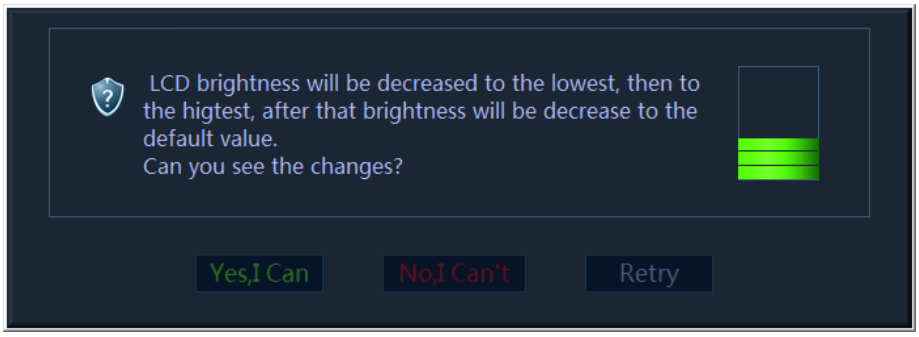
C.1.27 Z0503 LCD Monitor Brightness Control Test

1. Top test items

   LCD Monitor Adjust Data Check Test

2. Test content

   The dialog box appears when performing the test. The program controls the brightness of LCD via 12C bus. The brightness goes down to the lowest, and then goes up to the highest, then gets back to normal. If the brightness changes, click “Yes, I Can”, otherwise click “No, I Can’t”. If the user clicks “Retry” the system will repeat the procedure mentioned above.


LCD brightness will be decreased to the lowest, then to the higtest, after that brightness will be decrease to the default value.
Can you see the changes?
Yes,I Can
No,I Can't
Retry

- Analysis to test failure

The driver goes wrong if the test result appears *Error*.

The test result about Brightness control of LCD screen from the test person goes wrong.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) It is recommended to check the connection between LCD screen and the main board, and then replace LCD screen if the test result is *FAIL*.

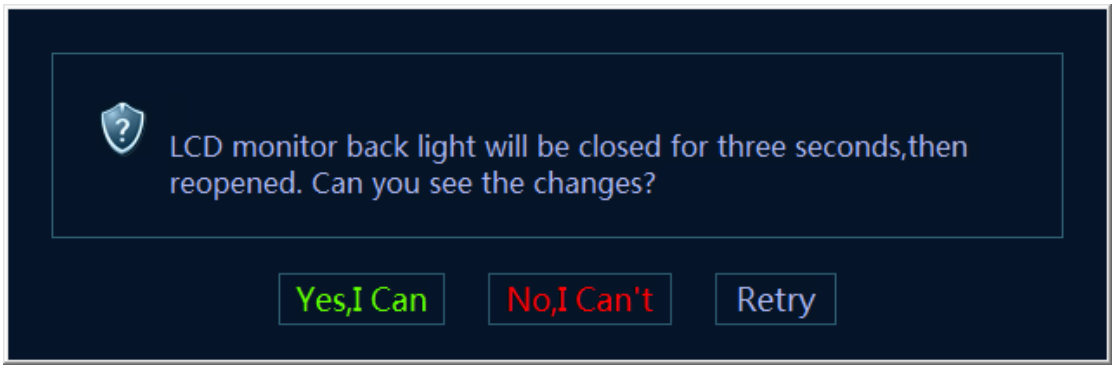
C.1.28 Z0504 LCD Monitor Backlight Control Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test

2. Test content

   The dialog box appears when performing the test. The program turns the backlight off for 3 seconds, and then goes back to normal. If backlight changes, click “Yes, I Can”, otherwise click “No, I Can’t”. If the user clicks “Retry” the system will repeat the procedure mentioned above.



   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The test result about Backlight control of LCD screen from the test person goes wrong.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to check the connection between the back-light board and the main board, and then replace the back-light board, replace the main board at last if the test result is FAIL.

C.1.29 Z0601 Touch Screen USB Interconnection Test

1. Top test items

   N/A

2. Test content

   Check whether the system recognizes the touchscreen device.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The touch pad board is not recognized by the operating system if the test fails.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace the touch pad board, and then replace CPU board if the test result is *FAIL*.

   c) It is recommended to check the connection between the touch screen and the main board, and then replace the touch pad board, replace the main board at last if the test result is FAIL.

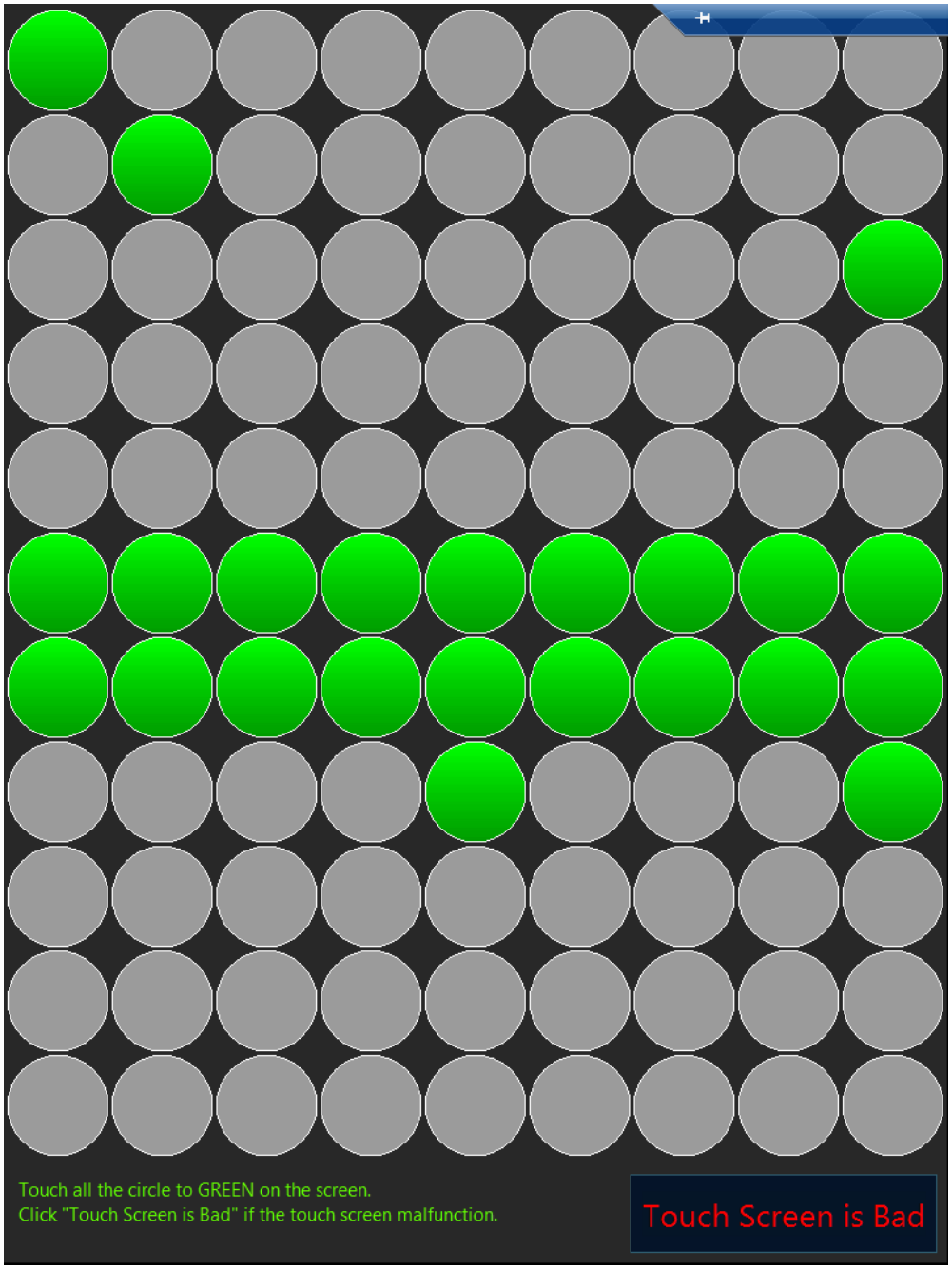
C.1.30 Z0602 Touch Screen Function Test

1. Top test items

   Touch Screen USB Interconnection Test

2. Test content

   The following dialog box appears on primary LCD monitor when performing the test. Scroll or flick the screen. The dots on the touchscreen become green. If the dots become green, the program passes, and then exits the test. If the dots remain grey, click “Touch Screen is Bad”.



- Analysis to test failure

The touch screen does not work if the test result is *FAIL*.

The test result of the touch screen function from the test person goes wrong.

3. Suggestion to failure test

   Confirm the driver of the touch screen is installed properly.

   Then confirm whether connecting material between the touch screen and the touch pad board is fixed well.

   It is recommended to replace touch screen.

C.1.31 Z0701 Left Battery I2C Interconnection Test

1. Top test items

   DSP FPGA and ARM Interconnection Test

2. Test content

   Read the left battery status when it is on the site via SM serial port, and test whether 12C bus communication between left battery and SM ARM works well.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The left battery and SM ARM go wrong if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) Test again after changing the left and right battery place to confirm the battery problem, and then change the battery if the test result is *FAIL*.

C.1.32 Z0702 Right Battery I2C Interconnection Test

1. Top test items

   DSP FPGA and ARM Interconnection Test

2. Test content

   Read right battery status when it is on the site via SM serial port, and test whether 12C bus communication between right battery and SM ARM works well.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The right battery and SM ARM go wrong if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) Test again after changing the left and right battery place to confirm the battery problem, and then change the battery if the test result is *FAIL*.

C.1.33 Z0703 Left Battery Test

1. Top test items

   Left Battery I2C Interconnection Test

2. Test content

   Read the voltage, temperature, current, volume and charging times, etc, via SM serial port.

- Analysis to test failure

The driver goes wrong if the test result appears *Error*.

The battery is not existed if the test result appears *NaN*.

The left battery goes wrong if the test result is *FAIL*.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) It is recommended to check if the battery is existed, if the test result appears *NaN*.
   c) Test again after changing the left and right battery place to confirm the battery problem, and then change the battery if the test result is *FAIL*.

C.1.34 Z0704 Right Battery Test

1. Top test items

   Right Battery I2C Interconnection Test
2. Test content

   Read the voltage, temperature, current, volume and charging times, etc from the right battery, via SM serial port.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The right battery goes wrong if the test result is *FAIL*.
3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) Test again after changing the left and right battery place to confirm the battery problem, and then change the battery if the test result is *FAIL*.

C.1.35 Z0801 ECG Board Information Read Test

1. Top test items

   PC Module and DSP FPGA Interconnection Test
2. Test content

   The program decides whether ECG is on the site, sends orders via ECG serial port, judges the returned data, and parses Bootloader version, board ID and software version.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The system will prompt “ECG Module is not on the site” if the test result appears *NaN,* it means ECG is not located or the located circuit goes wrong.

   The system will prompt “ECG Module information read test FAIL” if the test result appears *FAIL,* it means the communication error between ECG board and main board goes wrong.
3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

b) Check if there has ECG module or ECG module communication is normal if the test result is *NaN*.

c) It is recommended to replace ECG board if the test result is *FAIL*.

C.1.36 Z0802 ECG Board Self Test

1. Top test items

   ECG Board Information Read Test

2. Test content

   ECG sends self-test order when it is on the site via ECG serial port and analyzes the self-test result, and judges the status for A/D, Flash, DRAM, CPU, Watchdog, and Voltage 33

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   ECG board goes wrong if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to replace ECG board if the test result is *FAIL*.

C.1.37 Z0901 Board Temperature Test

1. Top test items

   DSP FPGA and ADT7462 Interconnection Test

2. Test content

   Read DC-DC circuit and AFE temperature value via ADT7462 driver.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

   The temperature value does not meet the requirement if the test result is *FAIL*.

3. Suggestion to failure test

   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.

   b) It is recommended to check the fan condition first and replace the main board if the test result is *FAIL*.

C.1.38 Z0902 CPU Temperature Test

1. Top test items

   N/A

2. Test content

   CPU overloads because of the software, read CPU's four temperature values via bottom driver. Judge whether they meet the requirements.

   - Analysis to test failure

   The driver goes wrong if the test result appears *Error*.

The system will prompt “CPU Temperature Test Fail. CPU0 Current temperature: <temperature value>, Limit temperature: <limits>;…” if the test result is *FAIL*. It means the temperature value does not meet the requirement.

3. Suggestion to failure test
   a) Restart the device and perform the self-test if the test result appears *Error.* It is necessary to restore Doppler software if *Error* re-appears.
   b) It is recommended to check the fan condition first and replace COME module if the test result is *FAIL*.

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